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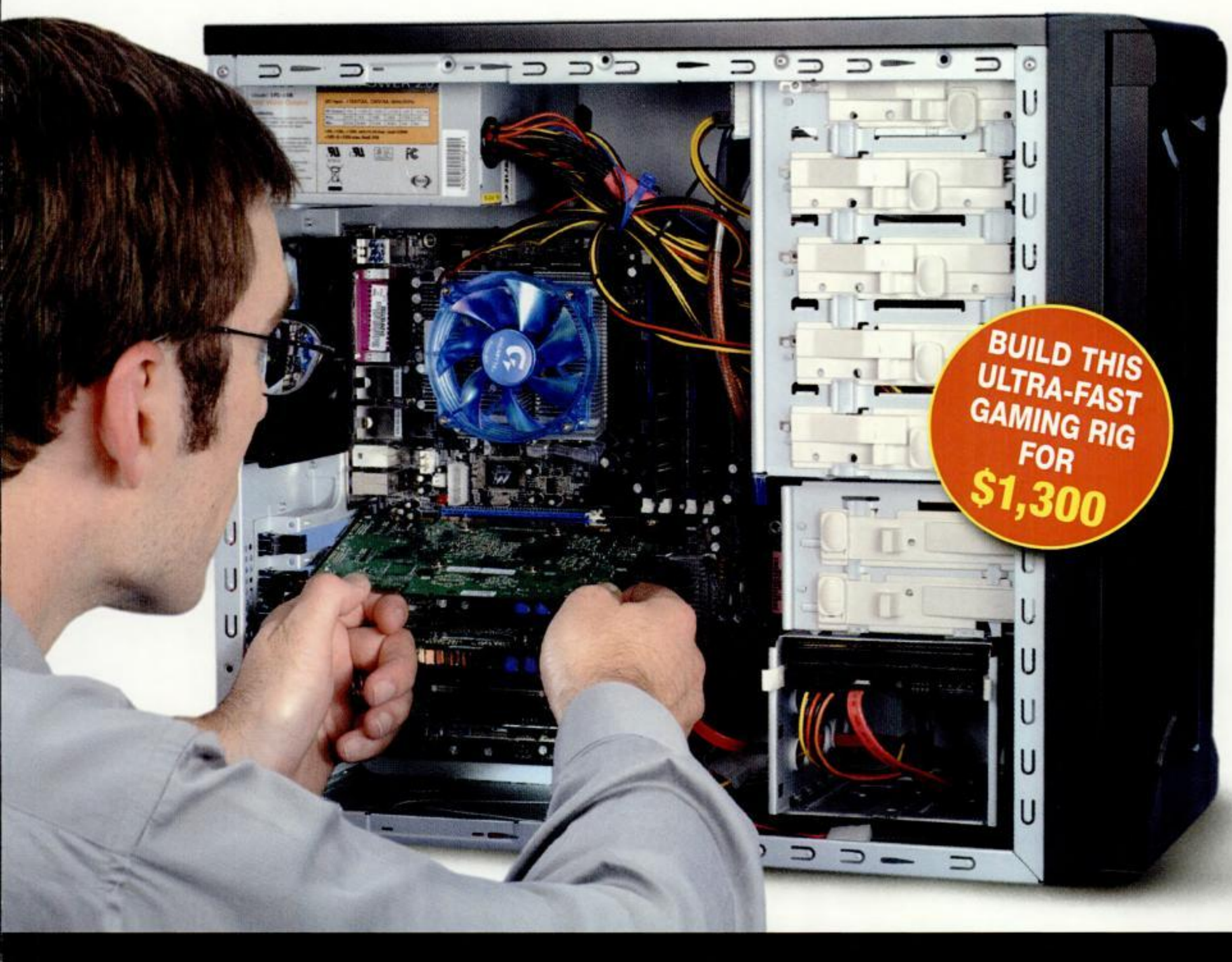

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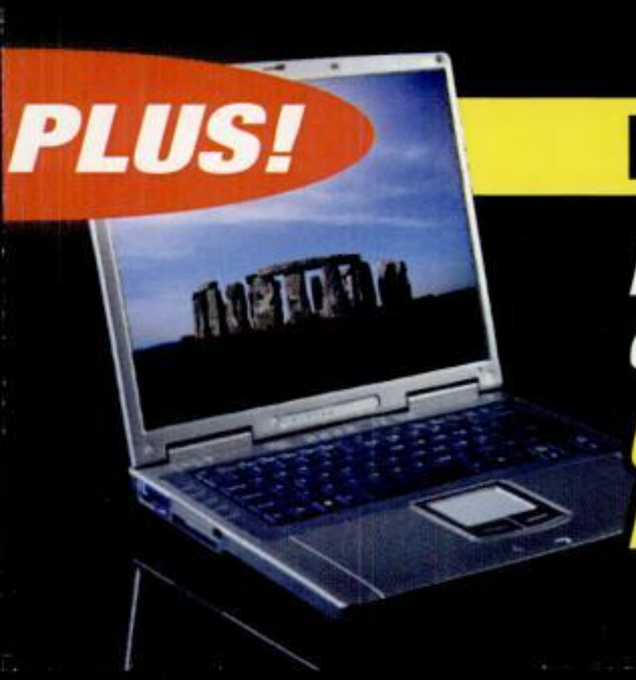

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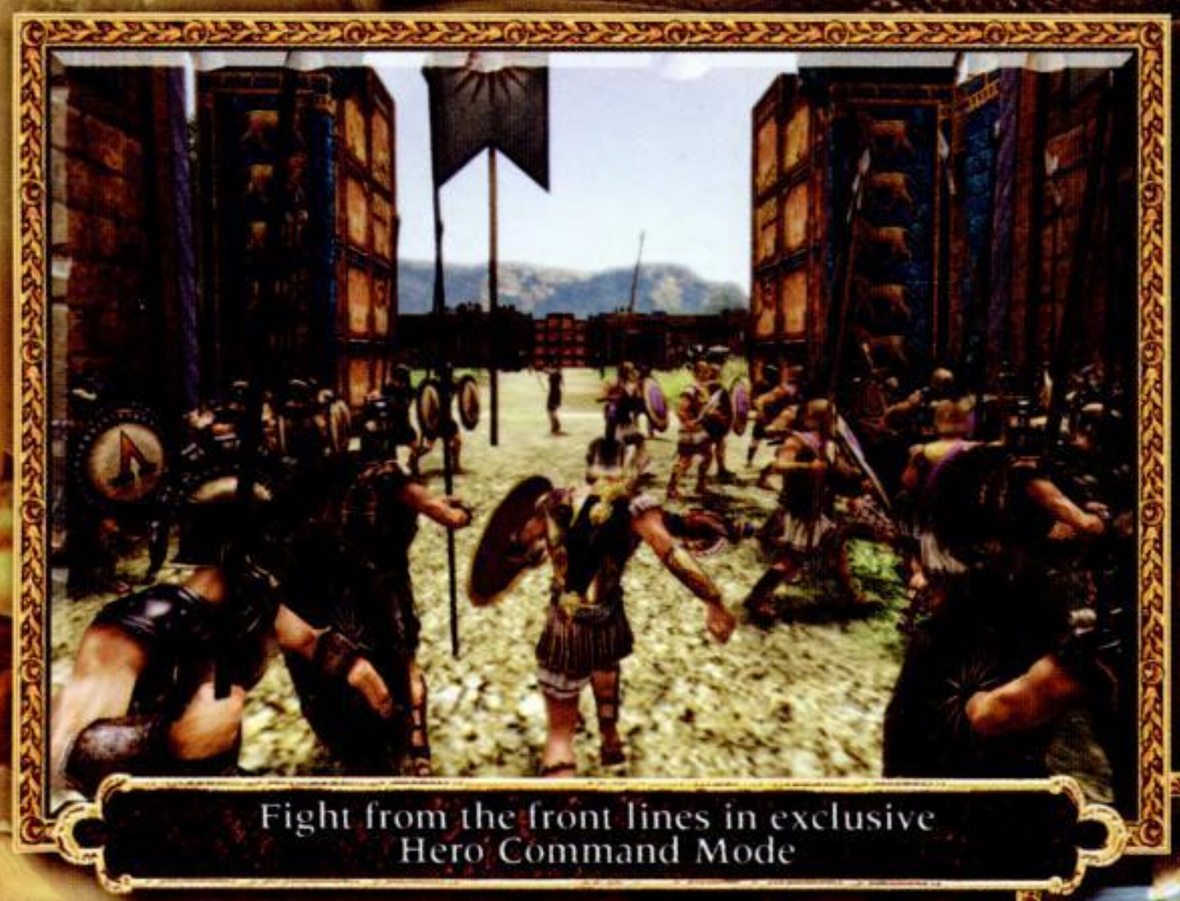

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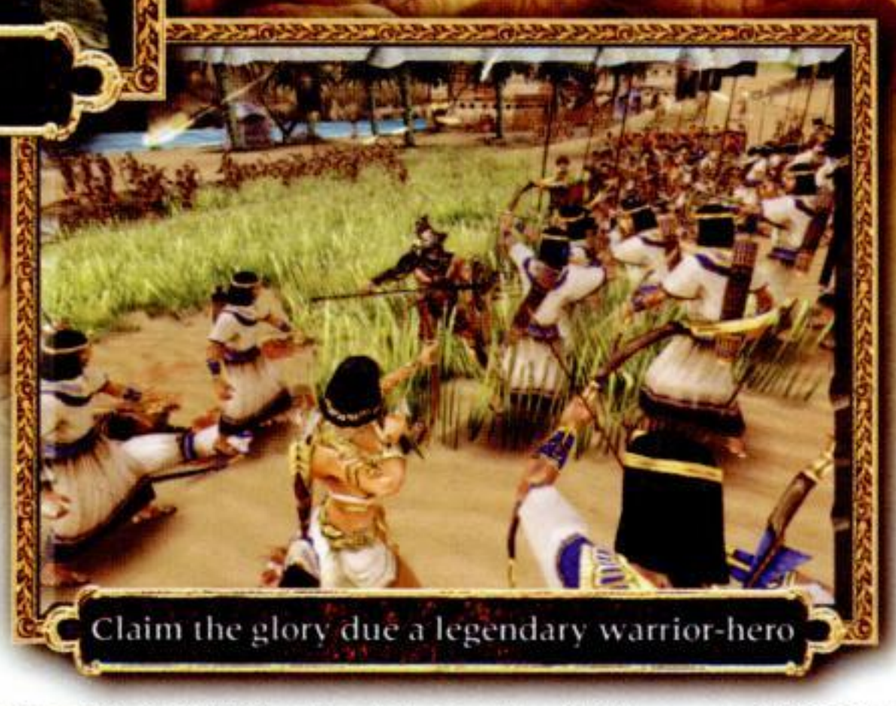

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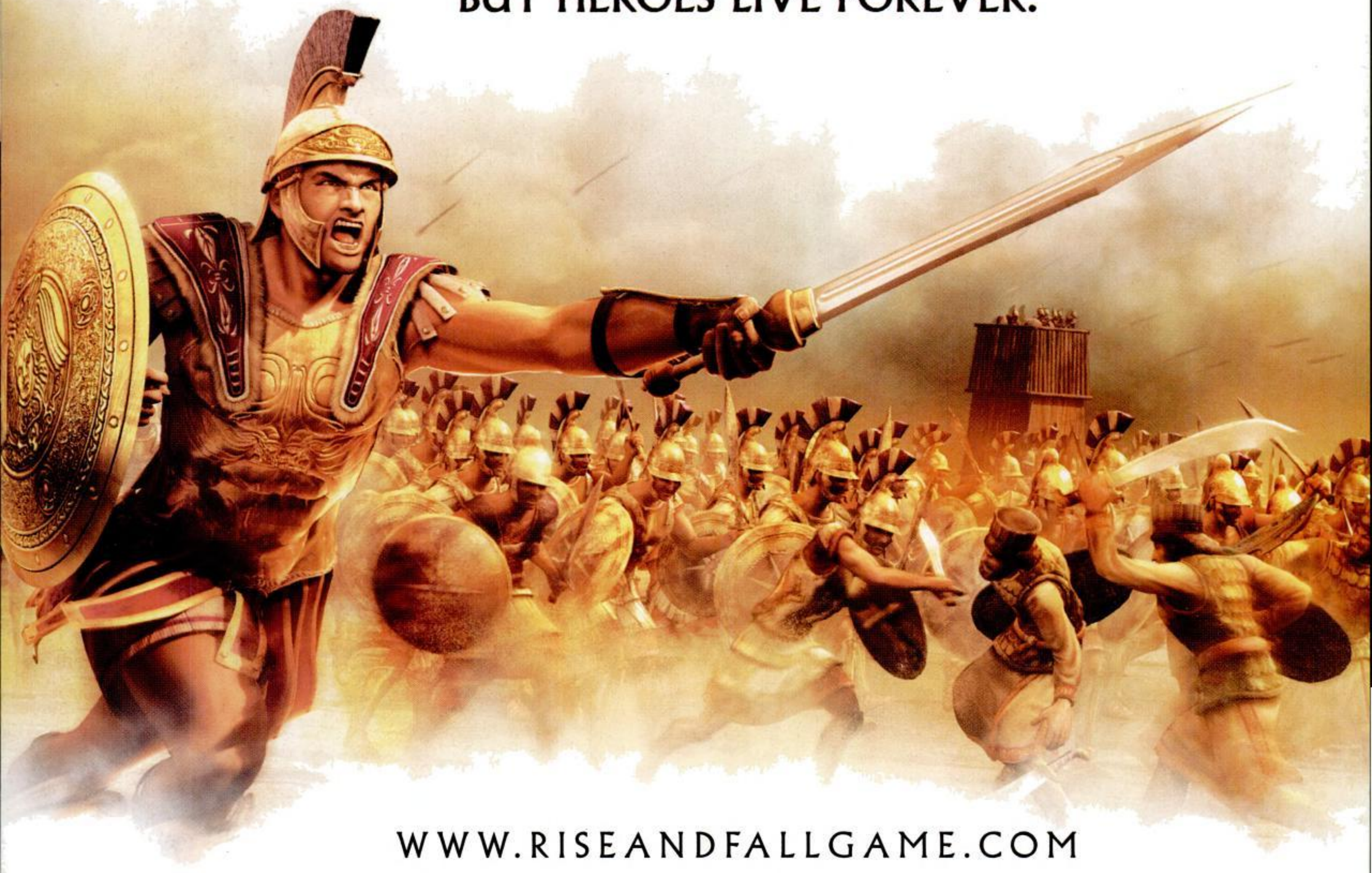

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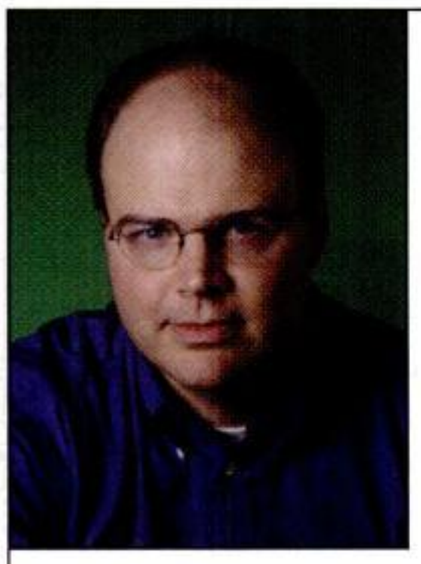

Release Notes

It's Time to Roll Your Own

I must admit I had some mixed feelings putting together this issue. On the one hand, I felt extremely good about putting the power to build a custom PC into your hands. On the other, I felt a little like a traitor to the "Geek cred" — sort of like a magician betraying his craft by showing you *exactly* how he took that rabbit out of his hat.

For years now, PC builders such as myself — and just about everyone at *Maximum PC* — have basked in the self-pride that comes with being the *only* person on their block, apartment building, or dorm who feels comfortable taking the door off of a PC case, rolling up their sleeves, and diving in. Whether it was to perform a complete system overhaul for a friend's machine, or perhaps just to help the comely coed down the hall swap out a videocard in her machine, we were the ones people came to for help with their PC hardware. And, I confess, it felt good.

Now you hold in your hands *all* of the answers, *all* of *Maximum PC*'s secrets about the art of constructing your own PC — from "scratch". We've held back nothing in showing you not only how to pull out that bunny, but how it got in the hat in the first place, too.

The honest truth is that building a PC today is typically just not as difficult as those who don't know the difference between a motherboard and a mother-in-law believe. (Shhh!) And with the falling costs of high-performance parts, it's never been more fiscally prudent to "roll your own." Why pay one of the big OEMs to give you a bare-bones rig that's incapable of running games when you can build your own gaming *beast* for around the same price, in roughly the same time it would take that OEM to ship theirs to you? (Okay, so you don't get a "free" printer, LCD, and puppy — but the trade-offs of superior performance and "I did it myself" pride are worth it!)

Our in-depth, illustrated guide gives you all the answers — everything you need to build a game-worthy PC, yourself, for as little as $975. We pick all the parts for you and then outline every step that's needed to put them all together. Whether you're new to the game or have built a few machines already, this guide is a must-read.

Just don't tell anyone how easy it was, okay? It'll be our little secret...

— Stephen P. Klett Jr.
sklett@maximumpc.com

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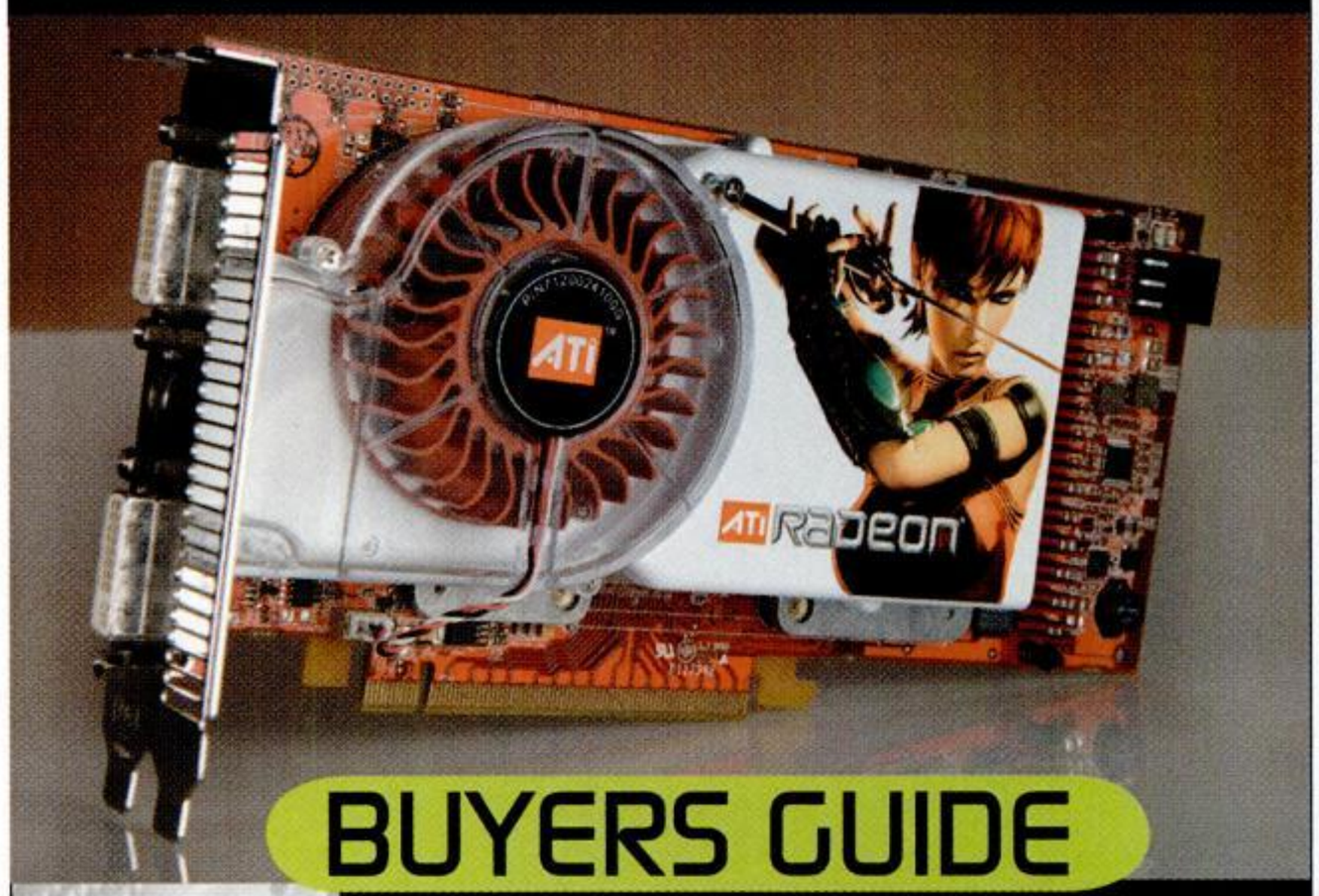

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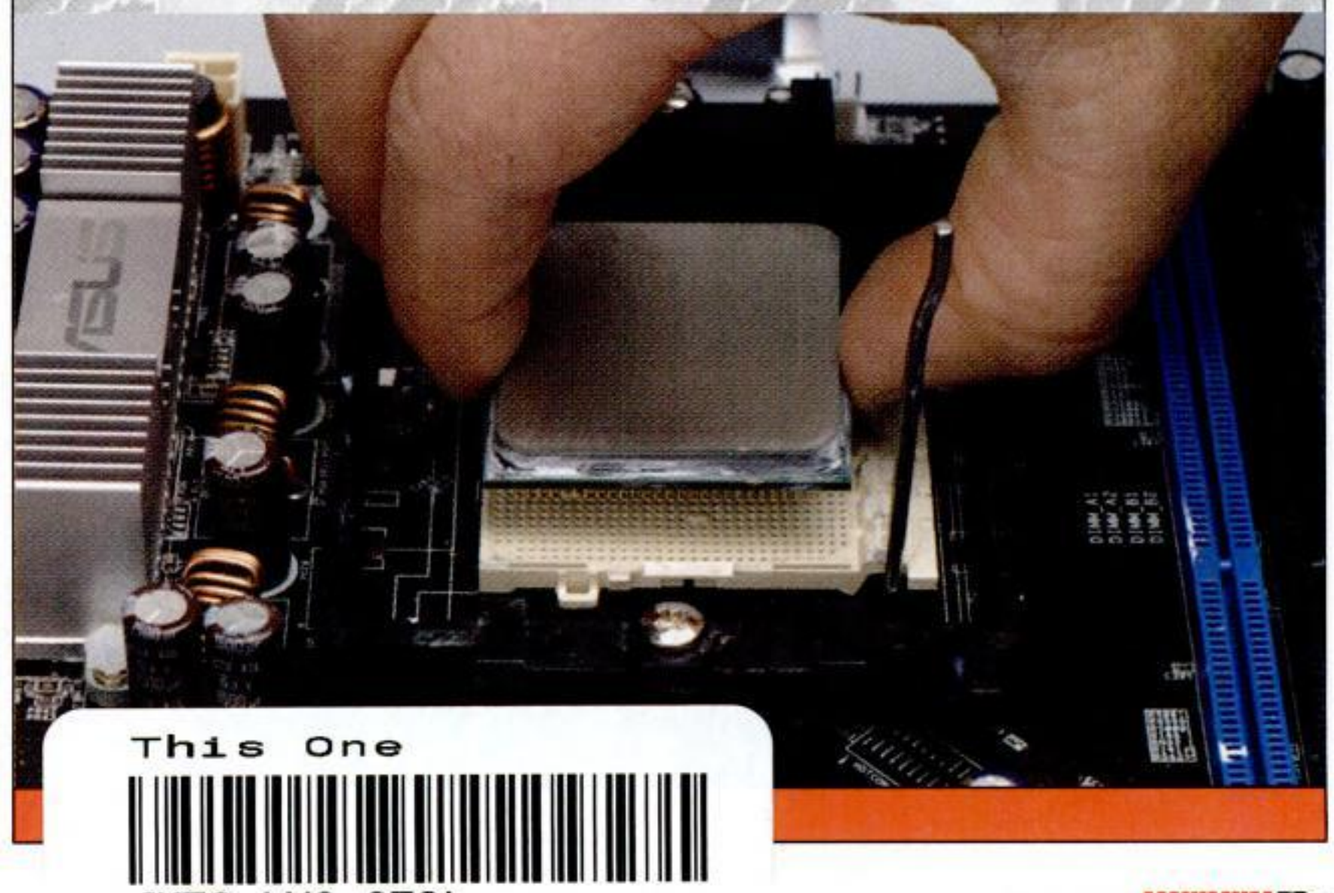

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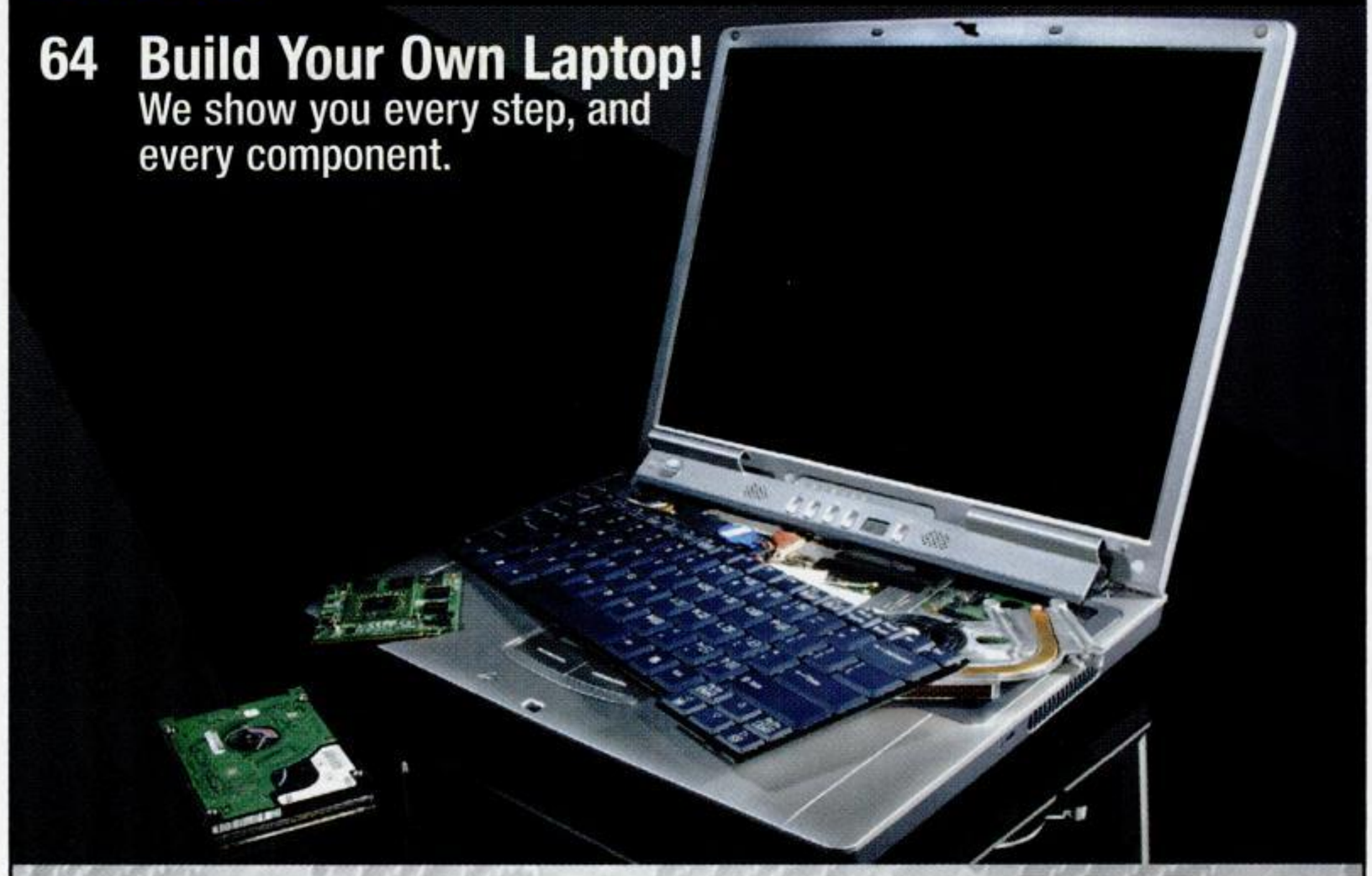

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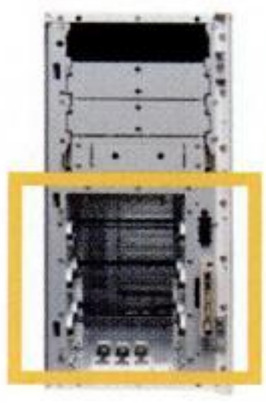

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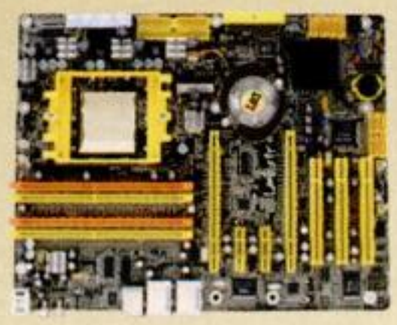

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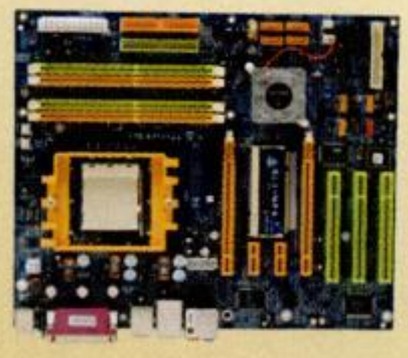

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HARDWARE BUYERS GUIDE

Let *Maximum PC* ease your transition from AGP to PCI Express. Here's everything you need to know before you make your next hardware purchase

BY *Maximum PC* Staff

TEN YEARS AGO, you really could build a PC in a vacuum. You bought a CPU, then picked the motherboard that had the features you wanted. All the CPUs used the same socket, so you could use any motherboard you wanted. Then you'd pick whatever graphics card you wanted, slap the parts together, and your dream machine was complete.

Unfortunately, things are much more complex today. The modern PC is an interconnected organism, where each subsystem relies on all the others. Now the CPU doesn't have to just fit the socket — it also has to be compatible with the chipset and memory. DDR RAM simply doesn't work with a DDR2 mobo. And if you want dual graphics cards, you'll need to pick the right motherboard for the job, or you'll be the guy sheepishly trying to return two $500 videocards at the local CompuBin.

We know you've got questions about your next upgrade, so we're here to get you up to speed and help you make the right choices before you buy.

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HARDWARE BUYERS GUIDE: CPU

We eat, drink, and breathe technology news every day, and even we have trouble keeping the CPU models straight, so don't feel bad if you can't

How Many Cores Do You Need?

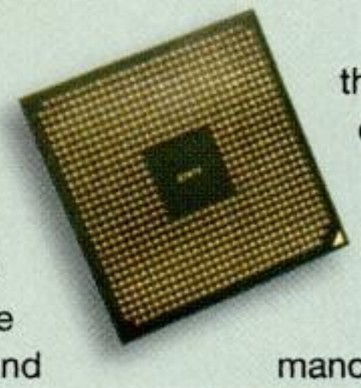
The number of CPU cores you need depends on how you use your computer. Do you typically perform only one task at a time, or do you frequently mix up your tasks, bouncing between different programs running simultaneously? If you're a unitasker, a single-core processor is probably your best bet right now. Single-core CPUs usually run at higher clock speeds than dual cores, and when doing just one thing, they're usually faster. Mind you, this won't always be the case: We predict that over the next couple years, the majority of applications will be written to take advantage of dual cores.

Dual-core CPUs feature two complete CPU engines inside a single package; and while the pair of CPU cores usually runs at a slower clock speed than a comparably priced single-core CPU, they share the processing load, which can actually boost performance over a single core, especially for multitaskers, or in applications written to take advantage of multiple CPUs.

Which Brand Is Right for You?

We've loved the unbelievable performance of the Athlon 64 CPU since its introduction, and we have absolutely no problem saying AMD is top-dog, especially if you're a gamer. The same holds true if you're using an application with a lot of floating-point math, or one that hasn't been recently rewritten and recompiled for the Pentium 4's NetBurst architecture, such as Adobe's *Premiere Pro* series. The upshot: Unless an application you need screams on Intel, we recommend you roll with the Athlon 64.

Which Is the Right AMD Processor?



AMD's lineup includes the budget Sempron, the mainstream Athlon 64, the dual-core Athlon 64 X2, and the performance-oriented Athlon 64 FX series. We recommend you stick with Athlon 64 and up—the Sempron just doesn't have enough oomph, and you can get slower-clocked Athlon 64s at competitive prices.

AMD rates its Sempron, Athlon 64, and X2 processors with model numbers, such as 3200+, 3800+, and 4800+. The difference is mainly in the CPU's clock speed, the amount of onboard cache it includes (more is better), and the number of cores it houses. A good way to determine a CPU's performance relative to the others is to remember that the higher the model number, the faster the chip will perform.

AMD's FX line is designed for gamers and performance-minded folks. The company makes two FX chips: the single-core 2.8GHz FX-57 and the dual-core 2.6GHz FX-60. If you're looking for top performance, both chips will give it to you, whether you go for one CPU core or two.

Which Is the Right Intel CPU?

Intel's lineup is a bewildering mess—we could write an entire feature just on how to decode the company's Rube Goldberg–esque naming scheme. There's the budget Celeron D, the midrange Pentium 4, the dual-core Pentium D, the single-core Pentium 4 Extreme Edition, and the dual-core Pentium Extreme Edition processors.

To further confuse matters, some of the Pentium processors support 64-bit OSes and some don't. All you need to remember is that for each family, the higher the number, the higher the performance. (Thus, a Pentium D 950 is faster than a Pentium D 930 or 820.)

The other big variable is Hyper-Threading. On the company's single-core chips, Hyper-Threading gives the processor a second virtual CPU core, so applications can use different areas of the CPU at the same time. Intel enables Hyper-Threading on its dual-cores and calls them Extreme Editions. If you're buying a dual-core CPU, it usually isn't worth the extra cash to enable Hyper-Threading. We think Intel's sweet spot is in the 9XX-series Pentium D chips. Avoid Celeron D chips, which are limited to a 533MHz front-side bus.

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HARDWARE BUYERS GUIDE: Motherboard

Choosing the wrong mobo will limit your other hardware choices, from CPU type and speed all the way down to the videocard you can use

Socket to Me

There are really only four different types of CPU sockets on the market today. For AMD CPUs you'll have to choose between Socket 754 and Socket 939. For Intel, it's Socket 478 or Socket 775 (aka Socket T or LGA775). Unless you're building a budget box for Grandpa, you'll want to stick with Socket 939 or Socket 775 for the widest support of processors and any hope of an upgrade path.

Dual-Core Support

You can't assume a new motherboard supports dual-core processors. Well, unless you're going to use AMD. Virtually all Socket 939 motherboards support dual-core X2 and FX CPUs. The older Socket 754, however, does not.

In Intel-land, dual-core support is another train wreck. Only certain chipsets will work with certain dual-core models. The 955X chipset technically does not work with the new Intel Pentium Extreme Edition 955. For that CPU, you need a 975X chipset. But some mobo vendors claim support for dual-core Pentiums on their 955X chipset boards. We recommend that you check with the mobo vendor before buying any board if you're planning on using an Intel dual-core processor. Thanks, Intel!

Some motherboards include two additional x4 PCI-E slots for future expansion.

AGP or PCI-E?

A lot of readers were disheartened to hear us say that AGP is dead. Some even wrote profane letters. We'll say it again: AGP is dead, Jim. If you're building a new system, don't waste your cash on an AGP motherboard or graphics card.

Forward-Looking CPUs

Before you buy a motherboard, you should research how close Intel and AMD are to releasing a new chip or standard. This fall, Intel will release the successor to the Pentium 4. Code-named Conroe, the CPU will be an LGA775 chip, but Intel won't guarantee it will work with existing LGA775 boards. Reliable sources tell us the chip should work with the current chipsets, but that it will have voltage requirements that could break some motherboards.

We expect AMD to introduce a new CPU supporting DDR2 this summer. This new chip will use a new socket design—Socket 940—and won't be compatible with Socket 939 boards. If you're a regular upgrader, it might make sense to wait for the new chips. If you can't wait, don't sweat it—the current Socket 939 boards and chips are quite capable.

Chipset

The core-logic chipset is the most important component on a motherboard. Mobo chipsets—primarily made by Intel, ATI, nVidia, and VIA—control how the CPU talks to the other components in your system. Many crucial functions are embedded in the chipset, from USB and SATA controllers to Gigabit Ethernet adapters. On Intel systems, the chipset also houses the memory controller (the memory controller is built into the CPU on AMD rigs).

The chipset generally determines which CPUs will work with the motherboard and can greatly affect the performance of the entire system. The three safe bets today for great-performing chipsets are Intel's 975X, ATI's Xpress 3200, and nVidia's nForce4 SLI x16.

Room for Expansion

Even though all modern performance motherboards include onboard RAID, SATA, Gigabit networking, and audio, you might still need to plug in an expansion card some day. Before you buy a board, plan your layout. If you think you're going to run two double-width graphics cards, how many and what type of slots will you have left? If you plan to add a higher-quality soundcard, you'll want a PCI slot, while a physics accelerator might need a PCI-E slot. Buy your board according to your computing needs.

Newer motherboards, such as the MSI K8N Diamond Plus, feature support for dual graphics cards running at x16 speeds.

Dual Graphics Cards or Not?

For gamers, dual graphics cards let you achieve far higher frame rates (and image quality) than you ever could using a single graphics card. After all, two cards are better than one! ATI's dual-card technology—called CrossFire—is supported on certain ATI and Intel chipsets. nVidia's solution—dubbed SLI, or Scalable Link Interface—works only on motherboards using an nForce4 SLI chipset. You'll have to decide what videocard brand you want to run before you purchase your motherboard.

Then there's the issue of PCI Express bandwidth. Newer PCI-E motherboards have two full-speed x16 PCI-E slots, while older motherboards deliver only a pair of x8 slots to the videocard. The upshot is that videocards that support up to 8GB/s of data throughput per card were plugged into motherboards that support only 4GB/s per card. Newer chipsets such as ATI's CrossFire Xpress 3200 and nVidia's nForce4 SLI x16 support dual x16 slots, so this is less of a problem going forward. Not that it was ever a huge issue in practical terms, as today's games don't really need the full bandwidth that x16 connections offer: It just doesn't make sense to spend money on a x8 motherboard when x16 parts are available.

HARDWARE BUYERS GUIDE: RAM

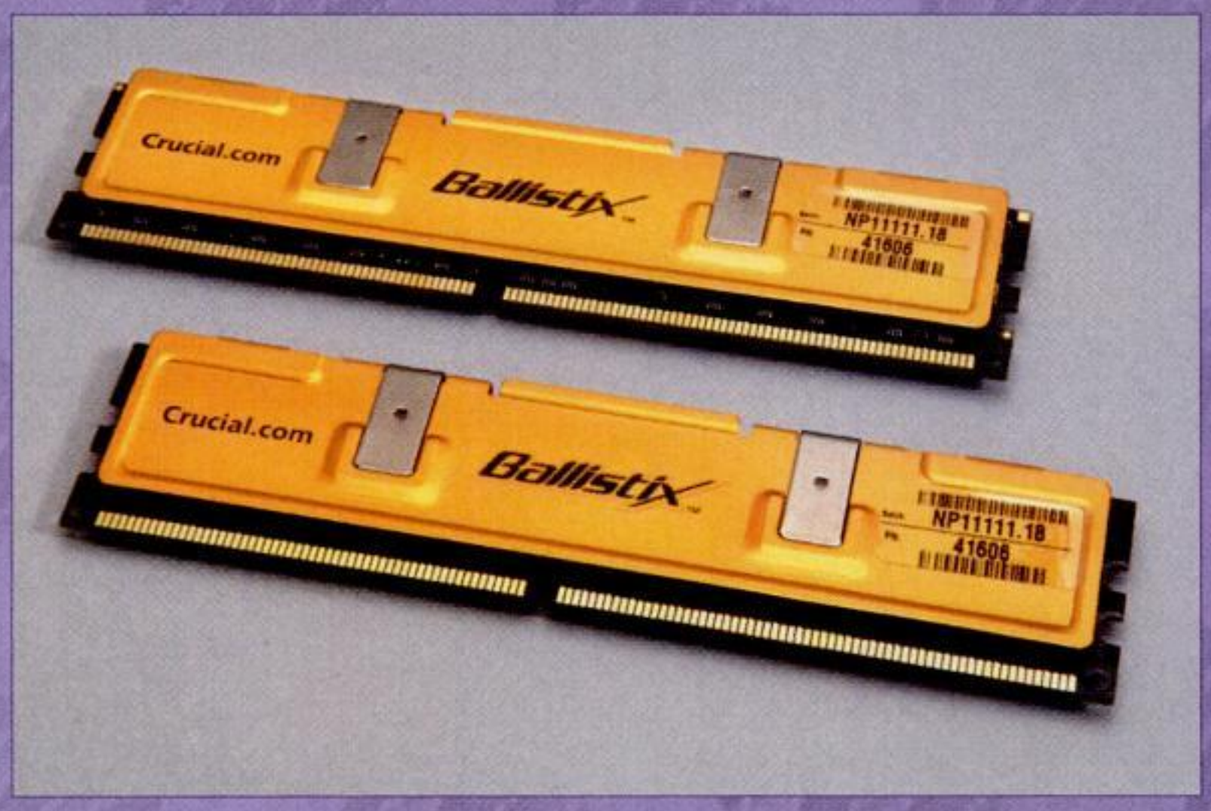
There are only two types of memory in common use today, but if you don't know what to buy, you can spend a ton of money on RAM that you don't need

Selecting the Right Type of RAM

Current AMD systems use DDR SDRAM, but with the company making the move to DDR2 this summer, that will become the de facto standard for all mid-range and high-performance PCs—not just Intel rigs. DDR2 increases bandwidth by allowing much higher clock rates and sending larger chunks of data at a time. For Intel, we recommend a motherboard that runs DDR2/667. If you're buying an AMD rig right now, you're stuck with DDR.

A Memory Clock Speed Primer

The most common memory today is probably standard DDR400 SDRAM, aka PC3200. The 400 in the name denotes 400MHz, which is the overall clock speed of the module, while PC3200 means the memory's theoretical bandwidth is about 3,200MB/s. DDR2 is similar to DDR but its speeds are higher and its bandwidth greater. A DDR2/667 module has an effective clock rate of 667MHz and is often referred to as PC5300 (denoting a theoretical bandwidth of 5,300MB/s). We refer to RAM by its effective clock speed rather than its theoretical bandwidth.



Get the Right Number of Modules

All modern motherboards support running two sticks of memory together in a "dual-channel" mode to increase bandwidth. In order to run in dual-channel mode, you have to buy memory in matched pairs. If you want a total of 1GB of memory, you need to buy two 512MB sticks. If you want 2GB, you'll need to buy two 1GB sticks, or four 512MB sticks of RAM. As a side note, you must install the memory in the correct channels to get dual-channel mode; your motherboard manual will detail the proper positioning.

How Much Memory Is Enough?

The minimum amount of memory we'll put in any kind of machine today is 1GB, but 2GB is rapidly becoming the standard. We've measured huge performance gains in some games by upgrading to 2GB, while many RAM-hungry applications, such as Adobe's *Photoshop*, are downright memory hogs. We don't expect memory configs to exceed 2GB until there's a viable 64-bit version of Windows available: Getting more than 2GB working in a 32-bit version of Windows XP is extremely problematic.

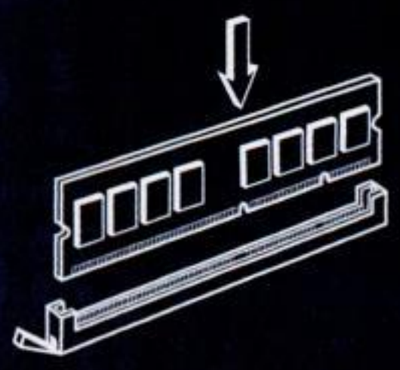
Next-Gen Memory Unveiled

Around the middle of 2006, we expect to see both Intel and AMD shift to the next speed bin of DDR2: DDR2/800. Because AMD's memory controller is located inside the actual CPU core, the company's DDR2 support will be tied to a new CPU and socket. We expect Intel to support DDR2/800 memory in a new chipset that will be paired with the next-generation Conroe CPU.

Just when you've stocked up on DDR2 RAM, you can expect it to become obsolete. Memory manufacturers are already spooling up DDR3 designs to replace DDR2. DDR3 will lower voltage to 1.5 volts from DDR2's 1.8 volts, which should be a boon for notebook users. DDR3 increases data rates by prefetching eight bits of data instead of the four bits of data that DDR2 does. DDR3 DIMMs will start to trickle out at the end of 2007.

CLICK

SCAN



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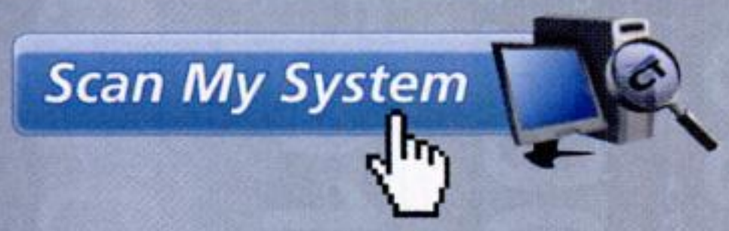

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HARDWARE BUYERS GUIDE: For Your UPGRADING Consideration...

Feast your eyes on these three mobos, which represent all the major enthusiast chipsets. Odds are, you'll find the perfect mobo for your next upgrade right here!

Asus P5WD2-E Premium

Asus has a message for the quiet-PC people who bitched about the 8,000rpm fan it used on the A8N SLI-Deluxe: "We hear you loud and clear." The P5WD2-E eschews chipset fans in favor of passive heatsinks.

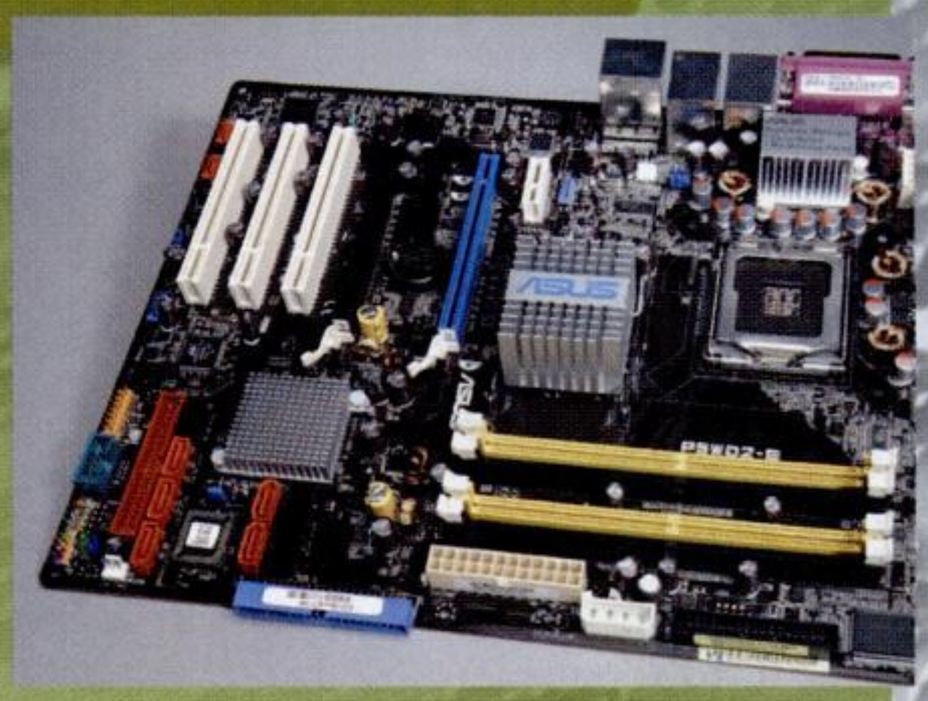
It helps Asus that Intel's 975X chipset doesn't require a ton of cooling to keep temps down. Unlike the exotic heat pipes and wind tunnels found on some mobos, Asus uses a pair of plain-looking aluminum heatsinks to keep the north and south bridges cool.

Officially, the board supports only ATI's CrossFire multi-videocard technology, but as with the other 975X-based motherboard in this roundup (Gigabyte's GA-G1975X), Asus also includes an SLI connector for using two nVidia cards in tandem. Wishful thinking, perhaps?

In terms of board amenities, Asus aces the Gigabyte board with support for eSATA and eight SATA ports. Asus took the conservative route, however, with the add-in board configuration—there are three 32-bit PCI slots, two physical x16 PCI Express slots, a x2 PCI-E slot, and an x1 PCI-E slot. The P5WD2-E isn't the greatest board for people who plan to add a lot of PCI-E devices, but there really aren't lots of PCI-E devices available now.

Asus also continues to provide the best manuals, replete with details on the board's inner workings that the other guys expect you to figure out on your own.

This board might be out-blinged and out-featured by some flashier offerings, but the P5WD2-E is no slouch. With virtually no performance difference between the boards in this story, we say buy the one that appeals to you.



Asus' 975X motherboard sports more PCI slots than it does new-fangled PCI Express slots.

Our only reservation about this board (and all 975X chipset boards) is whether it will support Conroe, Intel's successor to the Pentium 4.

ASUS P5WD2-E PREMIUM
$225, www.asus.com
8

MSI K8N Diamond Plus

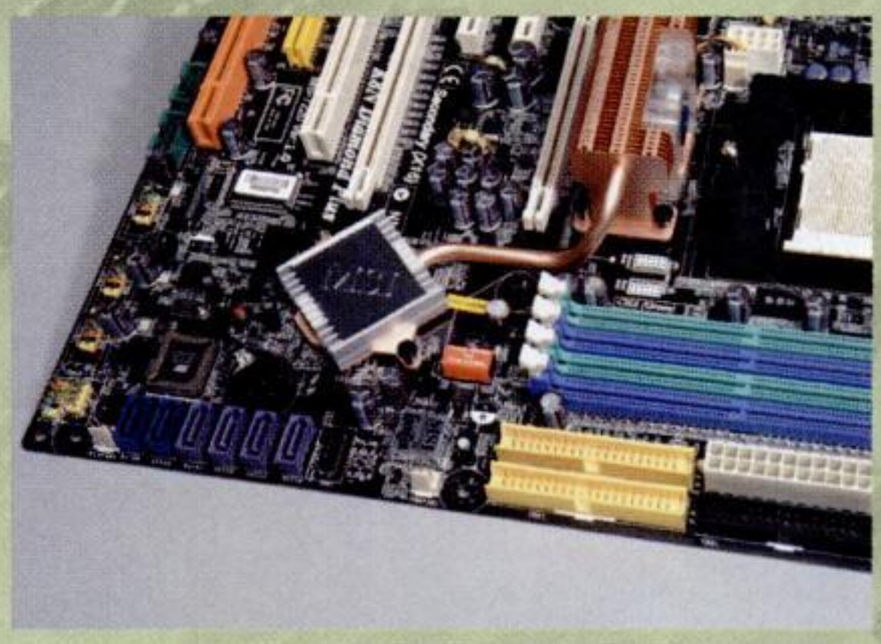
As the sole available mobo powered by nVidia's nForce4 SLI x16 chipset, Asus' A8N32-SLI Deluxe has had an easy three months.

That run might be over, now that we've had a good look at MSI's new K8N Diamond Plus. As the second motherboard to feature the dual x16 PCI-E chipset from nVidia, the K8N is good news for nVidia, which has faced conspiracy accusations from consumers who think the 32-channel chipset is vapor.

While the K8N is up against two ATI-chipset motherboards here, we suspect that most will want to see how the K8N does against the A8N32-SLI. Although we didn't formerly review the A8N-SLI here, we fired up the board and tested it alongside the others. Performance-wise, the two nVidia-powered boards were deadlocked. So it comes down to feature sets. Again, it's pretty durn close. Both use heat pipes—MSI chose active cooling while Asus lets you decide whether to use an active or passive cooler. And both have six SATA ports (Asus plumbs one port out the rear of the motherboard for eSATA).

But the MSI board clearly trumps the A8N32-SLI in audio. The MSI board features the Creative Audigy SE chip. You get hardware audio acceleration and a high-quality 24-bit Wolfson DAC—far superior onboard sound than the AC97 audio on the Asus board.

MSI's board also features a driver-finder application, which kicks serious ass. The included application downloads and installs driver updates, and will even flash the BIOS. We also like this board's convenient CMOS reset button as well as the LED POST diagnosis display bracket, but MSI forgot to put a surface-mounted LED on the motherboard to tell you that the system is drawing power. That's been a standard feature since about 1998.



Finally, another nForce4 x16 board! MSI's version offers an Audigy SE soundcard on the mobo.

Because performance is virtually the same for the two nForce4 SLI x16 boards, we've got to give the edge to the MSI K8N Diamond Plus for sporting a few unique key features.

MSI K8N DIAMOND PLUS
$225, www.msicomputer.com
9
MAXIMUM PC KICKASS

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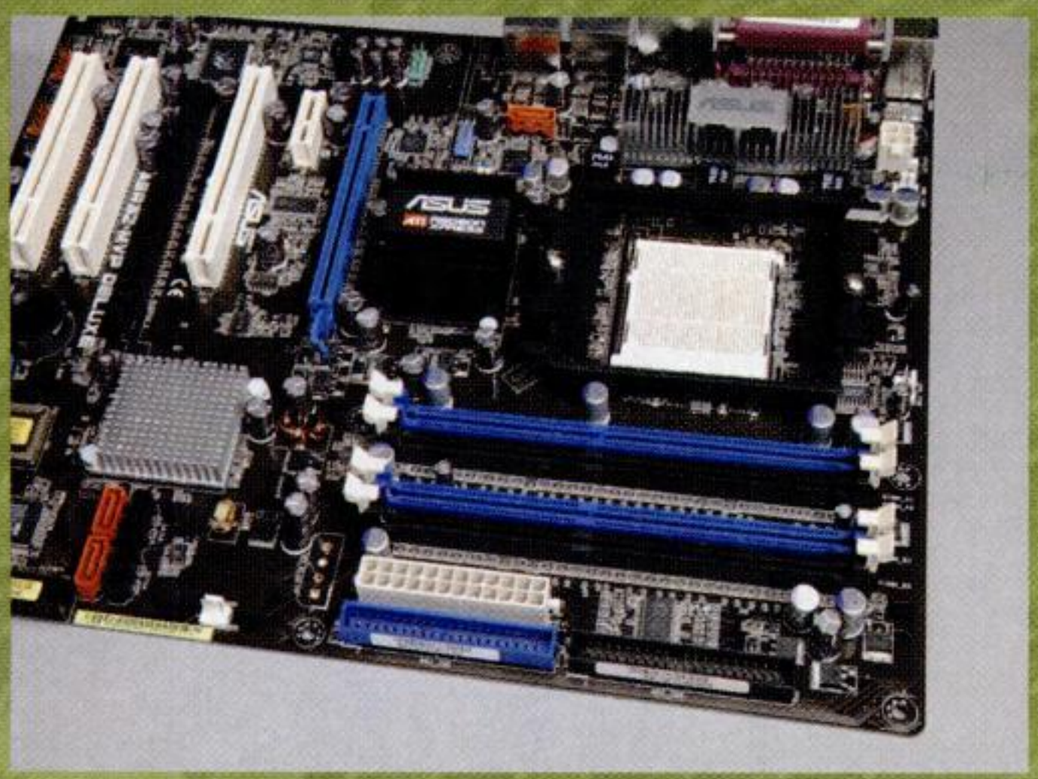


Asus' new A8R32-MVP Deluxe features a single-chip CrossFire implementation with support for two x16 PCI-E graphics cards.

Asus A8R32-MVP Deluxe

Asus was the first to introduce an SLI consumer motherboard and has been the sole maker of Athlon-based nForce4 SLI x16 mobos for the last three months. So we weren't surprised when the company produced the first mobo based on the brand-new CrossFire Xpress 3200 chipset. We had Asus' A8R32-MVP Deluxe in the Lab when other motherboard companies weren't even ready to talk about their plans. Because it uses the new CrossFire chipset, the A8R32-MVP supports dual x16 PCI-E graphics cards at full bandwidth.

On paper and in the marketing wars, the Xpress 3200 has a serious advantage over its nVidia counterpart in GPU bandwidth. While the single-chip north bridge is superior to nVidia's two-chip design, ATI still suffers in south-bridge performance—not to mention its lack of SATA 3G support. ATI still hasn't fixed those problems with the 3200, so Asus ditched ATI's SB450 south bridge in favor of an ULi M1575 controller. The M1575 offers more RAID options, better performance, and SATA 3G support. The layout of the board is no-nonsense and leans more toward legacy PCI devices than PCI-E cards.

ATI has boasted about how few transistors the Xpress 3200 needs, which translates into less heat. To keep the chipset cool, all Asus needed in this board was a pair of tiny passive heatsinks.

The A8R32-MVP performed well, although we did note some speed deficiencies in several benchmarks. The real-world impact was minimal, though, and the A8R32-MVP is the mobo to buy if you're going the ATI graphics-card route.

ASUS A8R32-MVP DELUXE — **$270, www.asus.com** — **8**

CROSSFIRE CONTROVERSY

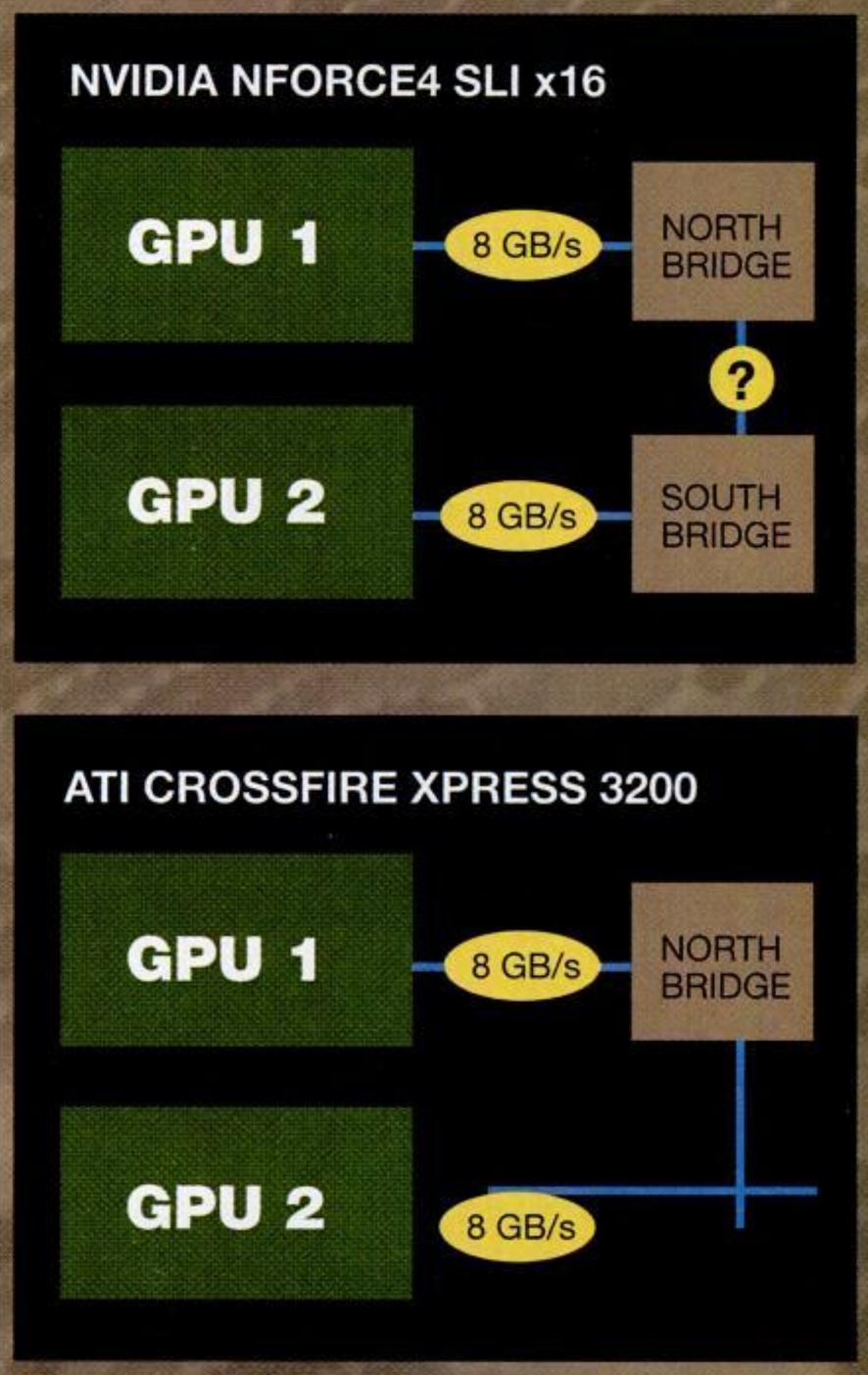
The latest version of ATI's chipset features a single-chip north bridge that gives it a performance advantage over nVidia—on paper, at least

It's safe to say that ATI is back in the graphics-card game with its kick-ass CrossFire X1900 XT cards, but the company has been a little lackluster in the chipset wars.

ATI's original CrossFire chipset (code-named RD480/482) played catch-up to the original nForce4 introduced more than a year ago. Its performance could definitely have been better. ATI designed the new RD580—aka CrossFire Xpress 3200—to catapult the company ahead of nVidia's nForce4 SLI x16 chipset.

Both chipsets support two graphics cards running at x16 data rates, but only the Xpress 3200 does it with a single chip. nVidia's Achilles' heel with x16 has been its two-chip solution. Each chip supports x16 graphics cards, but what good is that if the two are connected using something slower than 8GB/s? nVidia has never coughed up the precise interconnect speed, which implies to us that it's slower than 8GB/s. ATI also likes to point out that communication between two chips that are separated by two inches of motherboard traces is beset by painful latencies that are mitigated when everything is contained in a single chip.

There's no way to measure graphics performance accurately. You can't plug a pair of CrossFire boards into an nForce4 SLI system to test the PCI Express performance, nor can you test a pair of nVidia boards in a CrossFire system. Outside of a few theoretical situations, we have yet to see dual x16 slots make a significant impact on performance. With this generation of games and graphics cards, you just don't need that kind of bandwidth. We do see an architectural advantage to a single-chip solution; in fact, nVidia has touted its own single-chip designs in the past. Who is right? Until nVidia cards work on ATI mobos and vice versa, we probably won't find out.



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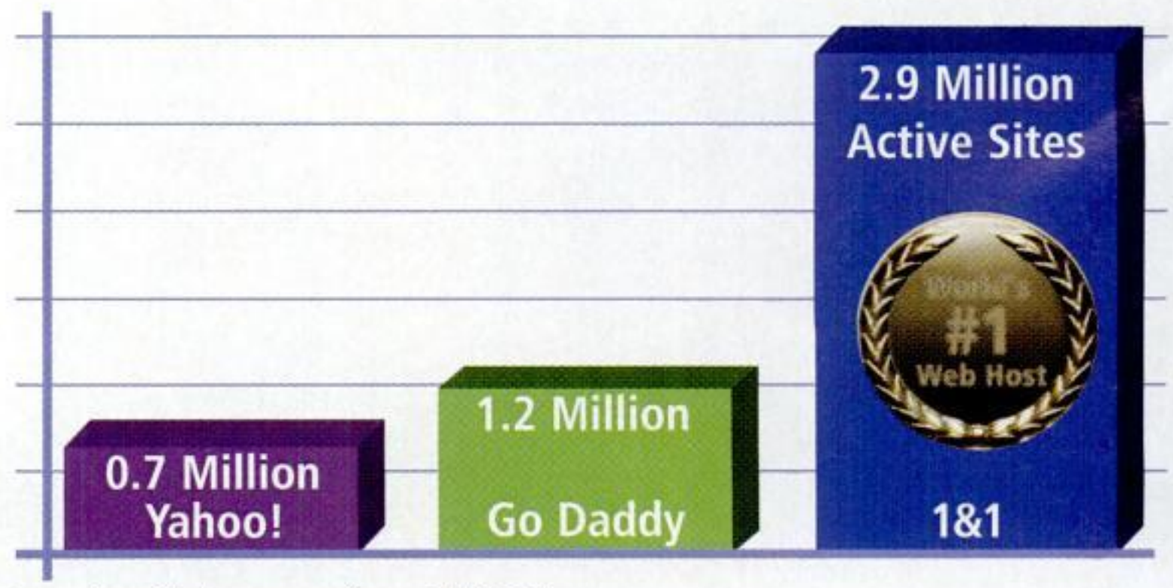

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SOFTWARE BUNDLE

Many videocard manufacturers offer "free" software—and sometimes hardware—bundles with their boards in an effort to differentiate their products from the competition. Shop around and you'll soon discover that the bundle is nearly always either a game, application, or gadget that you already own; an outdated version of a product; or something that you had previously decided you didn't want, need, or care much about. It's always reasonable to pay a little more for added performance, but most bundles are merely marketing gimmicks designed to lure the gullible. Benchmark results matter; bundles don't.

MEMORY

The amount of memory on the videocard helps determine the maximum resolution the card is capable of displaying. Budget videocards will have at least 128MB of DDR (double data-rate) RAM, but 256MB is the current sweet spot. DDR2 and GDDR RAM are capable of higher clock speeds than DDR RAM. GDDR RAM was designed specifically for 3D applications: It requires less electrical power and produces less heat than other types of RAM, and can run at even higher clock speeds.

MEMORY INTERFACE

The wider the connection between the videocard's GPU and its memory, the faster the GPU can process data. Budget videocards typically have a 128-bit interface to memory, while higher-end cards usually have a 256-bit interface. Usually it's better to have slower-clocked memory on a wider interface than higher-clocked memory on a narrow interface.

COOLING SYSTEM

Every component inside your PC generates some degree of heat, and videocards produce more than most. A simple heatsink isn't sufficient to keep a high-clocked GPU and memory cool, so manufacturers now mount fans on the circuit boards. ATI's current top-end GPU, the Radeon X850 XT Platinum Edition, gets so hot that it requires a large cooling fan that consumes two slots. nVidia's reference design for its newest GeForce 7800 GTX, which boasts a 110-nanometer process and sophisticated power-management firmware, needs only a single-slot cooler. If you have a cramped case, or need to use all of your expansion slots, you should look for a card that occupies only one slot.

BUS INTERFACE

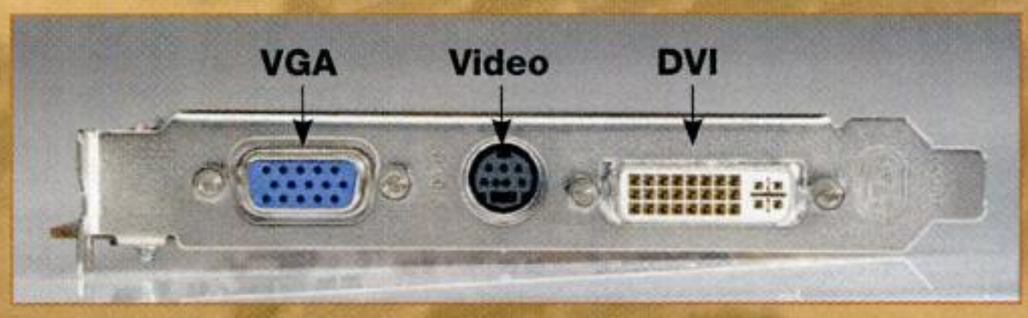
Your PC will have one of two types of videocard bus interface—AGP (Accelerated Graphics Port, shown in the top photo) or PCI Express (shown in the bottom photo). Make sure the videocard you buy is compatible with your motherboard: You can't plug a PCI Express card into an AGP slot, and vice versa. PCI Express is considerably faster than AGP, offering maximum bandwidth of 8GB/s, compared with just 2.1GB/s for AGP.

If your motherboard doesn't have PCI Express slots, your videocard pickins will grow increasingly slim. Neither ATI nor nVidia plan to support the older standard with their newest GPUs. And both companies' dual-GPU solutions—ATI's CrossFire and nVidia's SLI—require PCI Express, as well. If you want the best videocard performance and you're still scraping by with AGP, upgrade your motherboard before you spend money on a new card.

DISPLAY INTERFACE

Typically, videocards have two or three different types of ports you can use to connect your display: DVI, VGA, or TV-out. DVI is used to connect a digital display, such as an LCD, or it can drive an analog monitor via an adapter. VGA connects an analog computer display, such as a CRT. TV-out outputs an S-Video or RCA composite analog video signal that's compatible with consumer televisions, VCRs, and the like.

Most videocards have at least one DVI port and one VGA port. High-end cards offer dual DVI ports, so you can run two flat-panel displays in digital mode, or any combination of analog and DVI displays with the appropriate adapters. Cards that support TV-out usually include a breakout cable with connectors for composite, S-Video, and—if the card supports high-definition TV—component video. Better cards will have a VIVO (video-in/video-out) port instead of TV-out. This type of port can both input and output a TV-compatible analog video signal. Videocards with VIVO ports can digitize analog video in real time, which makes them suitable for basic nonlinear video editing.

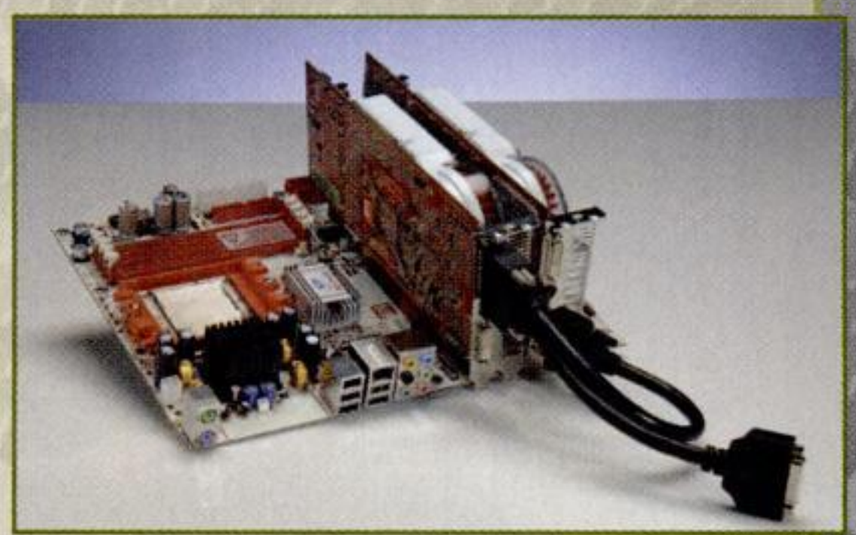


nVidia SLI vs. ATI CrossFire

Interested in putting one of those new-fangled dual-videocard systems from ATI or nVidia in your PC? Take a look at the core-logic chipset on your motherboard first.

If you have nVidia's nForce chipset, you're limited to running nVidia GeForce cards; if you have ATI's Xpress chipset, you're limited to running ATI's Radeon cards.

Running high-end nVidia cards in SLI requires a physical connection inside the case.



ATI's CrossFire solution is less elegant, requiring a three-headed cable outside the case.

THE ARCHITECTURE

For the record, we favor nVidia's nForce chipset over ATI's Xpress because nVidia's technology is more mature and is generally perceived to be more stable. Once you've decided on a chipset, your next objective is to choose between motherboards that support 16 lanes in each PCI Express slot in dual-videocard mode, and motherboards that support only 8 lanes in each PCI Express slot in dual-videocard mode. (Operating in single-card mode, the latter will support 16 lanes in one PCI Express slot and 8 lanes in the other.) Your decision will almost assuredly be based on your budget: Whether powered by ATI or nVidia, motherboards that support 32 PCI Express lanes in dual-videocard mode cost nearly twice as much as ones that support 24.

If you're buying a new PC or motherboard and you don't give a rip about chipsets, your decision will be based on these two factors: which GPU architecture delivers superior performance, and what you think of the two decidedly different methods of connecting dual videocards. Let's tackle the connection issue, first.

THE HOOK-UP

nVidia's SLI technology is older, but it's also more elegant. At the higher end of the nVidia product range (the GeForce 6600 GT and up), the two videocards in an SLI system communicate over an SLI connector inside the case. (This internal connection, incidentally, enabled nVidia to recently come up with a *four*-GPU solution, dubbed Quad SLI.) At the lower end of nVidia's product range, there's sufficient bandwidth on the PCI Express bus that this connector isn't needed. In either situation, the two cards can be from different manufacturers, but each must be based on the same model GPU (although clock speeds can vary).

The high end of ATI's product range (cards based on the Radeon X1800- and X1900 series) depend on a CrossFire master videocard and a slave videocard, with the two connected via a cable *outside* the case. The slave card passes its rendering output over this cable to the master card, where a compositing chip combines it with the output from its own GPU to create a coherent frame of video. At the lower end of ATI's product range (cards based on the company's Radeon X1300 and X1600), two cards operating in CrossFire mode communicate over the PCI Express bus and don't need an external cable or a master card. Here again, the two cards can operate at different clock speeds.

THE BOTTOM LINE

When you compare the benchmark performance of videocards based on ATI and nVidia GPUs, you'll see that the two camps are pretty close in terms of their price/performance ratios: ATI wins some categories by a nose; nVidia takes the prize in others by similar margins. However, nVidia's solution winds up being slightly less expensive, which combined with nVidia's superior chipset gives SLI win.

VIDEOCARDS	AVERAGE STREET PRICE *	3DMARK05	DOOM 3 (FPS)	FAR CRY (FPS)	HALO (FPS)
ATI X1800 XT w/ X1800 **CROSSFIRE**	$965	11,985	87.2	158.9	139.9
Two nVidia GeForce 7800 **GTX IN SLI**	$930	12,521	92.3	158.6	138.7
ATI X1900 XTX w/X1900 **CROSSFIRE**	$1,125	12,751	94.7	173	146.6
Two nVidia GeForce 7900 **GTX IN SLI**	$1,108	12,748	98.8	157.4	140.4

**ATI prices based on the average street price of one CrossFire master card, plus one slave card using the same GPU. nVidia prices based on the average street price of two cards using the same GPU.*

Point your browser to www.maximumpc.com/benchmarks for details on our benchmarking procedures.

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VIDEOCARD BUYERS GUIDE

Best Budget Videocard

PNY Verto GeForce 6800 GS

The words "budget" and "performance" typically fit together about as well as "Dick Cheney" and "cream puff." But thanks to nVidia's sweet GeForce 6800 GS and a little overclocking work from the engineers at PNY Technologies, budget-minded upgraders can lay their hands on one powerfully cheap videocard.

If you can spring for two of these and run 'em in SLI—either now or a little ways down the road—you'll be the proud owner of a rig that can not only hang with boxes powered by the likes of a single GeForce 7800 GTX 512MB or an ATI X1900 XTX, but will also outrun them on many benchmarks. Really.

Although the 6800 GS has only 12 pipes, its high clock speeds, 256-bit memory bus, and increased transistor count enable it to deliver better performance than a 16-pipe 6800 GT, which is outfitted with only a 128-bit memory-interface. nVidia accomplished this trick by taking the GeForce 6800's basic architecture and moving it from a 130nm fabrication process to a 110nm process. In fact, the benchmarks for PNY's card come within spitting distance of the 6800 Ultra—not bad for a card that was selling for just $219 at press time.

This card manages to get by with a single-slot cooler, despite its GPU being clocked at 470MHz (compared to 425MHz in nVidia's reference design) and its 256MB of memory being cranked up to 550MHz (compared to the stock 500MHz). The fan is fairly quiet, but we wouldn't recommend installing it in a home-theater PC if you're sensitive about noise.

Our only real criticism stems from PNY's decision to include just one DVI output along with a TV-out; the remaining output is a lowly VGA. Aside from that shortcoming, this is one of the best videocards in this price range.

PNY's GeForce 6800 GS implementation is downright peachy: Gaming on a budget has never been so much fun.

PNY VERTO GEFORCE 6800 GS
$220, www.pny.com
9
MAXIMUM PC KICKASS

Best Mid-Priced Videocard

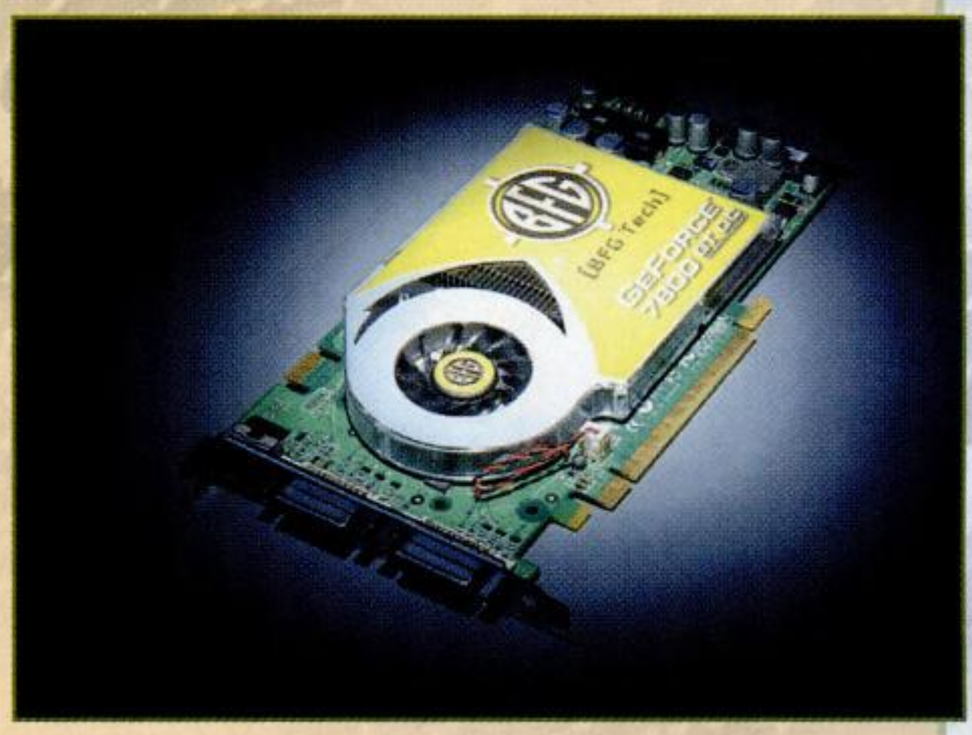
BFG GeForce 7800 GT OC

Bringing a new GPU to market requires a huge research-and-development budget, and manufacturers count on eager early adopters to recoup much of those expenses. Frugal consumers who still want the best learn to cool their jets and let the other guy shoulder the premium price tags.

And that brings us to BFG's GeForce 7800 GT OC. nVidia sucker-punched rival ATI just as ATI was bringing out its first generation of Shader Model 3.0-capable parts, including the X1800 XL. Viewed in terms of clock speeds, the X1800 XL looks superior: its core is clocked at 500MHz, and the 7800 GT's stock speed is just 400MHz. But the 7800 GT is outfitted with 20 pixel pipelines, while the X1800 XL has just 16. And when BFG factory-overclocked the 7800 GT to 425MHz, and cranked the clock on the card's 256MB of memory up to 525MHz, ATI's offering was simply outgunned.

The frame rates that these cards achieve with today's popular games tell the tale better than words. Whereas BFG's card delivered *Far Cry* at 1600x1200 resolution with 4x anti-aliasing and 8x anisotropic filtering at 84.2 frames per second, the X1800 XL managed to squeeze out only 80.7 frames per second. And the two cards' performance with *Doom 3* points out an ongoing weakness with ATI's OpenGL drivers: BFG's nVidia-powered card produced a playable 46.2 frames per second at the same demanding values we tested with *Far Cry*. The card featuring ATI's X1800 XL managed a paltry 39 frames per second. Got a few more bucks to spend? Take a look at cards powered by the even stronger GeForce 7900 GT.

One area in which ATI is currently boxing nVidia about the ears, however, is in terms of image quality. Although ATI initially stumbled with the introduction of its much-hyped Avivo technology—present in every X1000-series GPU—they've since released drivers that harness it to great effect. nVidia needs to catch up.



You guessed it: The "OC" in BFG's GeForce 7800 GT OC stands for "overclocked."

BFG GEFORCE 7800 GT OC
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ATI's High-End Graphics Processor

Radeon X1900 XTX

After failing to deliver on some mighty big promises with its R520 architecture (the X1800 series), a humbled ATI went quietly back to the drawing board. And this time, it came up with a winner: The X1900 XTX—powered by the R580 GPU—is a beauty and a beast.

In the process, ATI successfully challenged some of our assumptions about what makes a powerful videocard. Based on the spectacular performance of nVidia's 20-pipe GeForce 7800 GT and 24-pipe 7800 GTX, our eyebrows went up when we heard that the X1900 XTX would have only 16 pipes. But ATI proved us wrong. By pairing those 16 pipes with 48 pixel-shader units, the company managed to build a part that's slightly faster on most benchmarks than nVidia's 512MB 7800 GTX.

But we're less impressed by the X1900 XTX's speed than we are by its image quality. ATI had boasted that its Avivo technology would improve every aspect of the visual experience, but early drivers failed to expose its best features. We had all but dismissed Avivo as marketing hype, because nothing we saw in ATI's dog-and-pony shows materialized in the products we reviewed.

But the drivers ATI released in conjunction with the X1900 XTX changed everything: This card's HQV benchmark score spanks nVidia's PureVideo decoder scores—the difference in color saturation (which the HQV benchmark doesn't measure) is absolutely striking: Avivo is for real. Besides, Avivo improves the quality of all video, while PureVideo only works with MPEG-2 videos.

It's interesting to note, however, that a single X1900 XTX runs slightly faster in a motherboard powered by nVidia's nForce4 chipset than it does with ATI's own Radeon Xpress 200 CrossFire Edition chipset. But if you're interested in running two of these cards in CrossFire mode, ATI's chipset is the only game in town.

We dig the X1900 XTX's performance, but we're less enamored with the card's noisy cooling fan.

RADEON X1900 XTX
$550, www.ati.com
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nVidia's High-End Graphics Processor

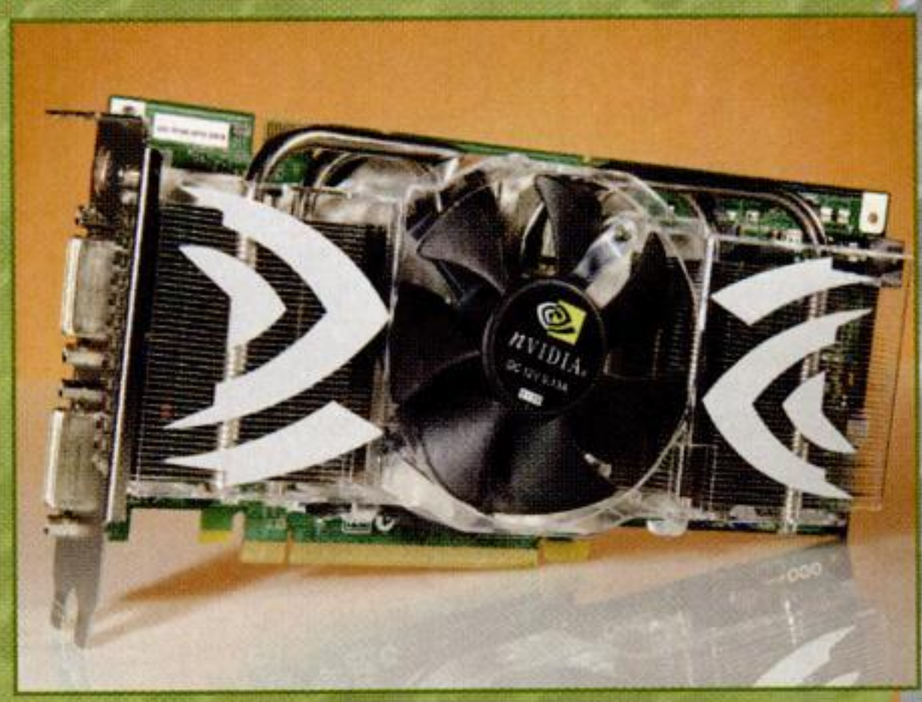
GeForce 7900 GTX

The bulk of our 3D benchmark scores tell us that one 7900 GTX is just slightly faster than a single Radeon X1900 XTX. We saw similar results running two of these monsters in SLI. It's not a blow-out, but two 7900 GTX cards did pull out in front of two of ATI's best in CrossFire mode to claim the dual-card performance crown.

There's one area, however, in which ATI maintained the lead it established when it finally shipped drivers that unleashed the power of its Avivo technology: video image quality. However unlikely the scenario might be, if you use your PC primarily to watch DVD movies, we think ATI has the better solution—and it doesn't cost anything extra. This advantage disappears in CrossFire mode, however; in fact, you must disable CrossFire in order to enable Avivo.

nVidia builds this chip using a 90-nanometer manufacturing process, which enabled the company's engineers to shrink the part's die size to 196 square millimeters (the previous top-end chip, the 7800 GTX, measured 334 square millimeters; ATI's X1900 XTX is 352 square millimeters). It also allowed engineers to realize design efficiencies that helped them reduce the new chip's transistor count from the 7800 GTX's 302 million transistors to 278 million.

The benefits of these design changes manifest themselves in both a higher core-clock speed—700MHz—and lower power consumption (our tests indicated 275 watts at peak for a single card and 360 watts at peak running two cards in SLI). The new card's 512MB of memory is actually clocked slower than that of the 512MB 7800 GTX (800MHz vs. 850MHz). Less power draw equals less heat, and this enables nVidia to use the same quiet dual-slot cooler from the 512MB 7800 GTX. If you're looking for the ultimate dual-GPU solution, the GeForce 7900 GTX is the way to go.



nVidia's GeForce 7900 GTX packs an abundance of pixel pipelines: 24, to be exact.

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How to Buy a Hard Drive

Do you really need to spring for 10,000rpms?

Hard drives have improved by leaps and bounds in the last few years, and while a super-fast drive won't improve your frame rate at all, it can certainly help levels load faster and provide more than enough space for all your games, MP3s, and more. The most important features to consider when shopping for a gaming drive are buffer size, storage capacity, and rotational speed.

BUFFER: Every hard drive has a tiny bit of onboard memory that is known as the buffer, or cache. When data is retrieved from the platters it is put into the cache so that if you close something that you just retrieved (say, a Word document) and then you suddenly decide you need to open it again, the document can be read directly from the cache. This saves the drive's read/write heads from needing to go all the way back to where the file was on the platter to read it again. It also saves a lot of time, as data can be retrieved from memory almost instantly.

A general rule with buffer size is the bigger, the better. Today's minimum is 8MB, and several high-end drives now ship with 16MB buffers.

CAPACITY: As with cache, the general rule with capacity is the bigger, the better. Though everyone's size requirements are different, we find a safe rule of thumb is 250GB as the minimum for a high-end gaming machine. Drives are available today in sizes ranging from 80GB all the way up to 500GB, so it's generally true that drives in the 200GB-to-250GB range are in the "sweet spot" in terms of price and capacity. However, prices on the big boys are falling: When 500GB drives debuted last year, they cost $500 — now you can get them for less than $300.

INTERFACE: Two interfaces are available for hard drives, and there's not much difference between them in terms of performance, so when deciding which is right for you the primary consideration should be what type of ports your motherboard offers. The standard interface is called Parallel ATA (also known as ATA or Ultra ATA). This interface uses a 40-pin connector with wide, flat ribbon cables; has been around for quite some time now; and is found on all motherboards. The parallel interface is currently being phased out in favor of a newer, faster interface named Serial ATA, which uses thin cables. SATA's benefits include the fact that you don't have to set jumpers (which is required with ATA devices), and that its smaller cables don't inhibit airflow as much as the archaic ATA cables.

ROTATIONAL SPEED: Because hard drives operate by rotating a platter underneath a pair of read/write heads to retrieve data, the faster the platters spin, the less time you spend waiting for data to be retrieved. The most common rotational speed for consumer-level hard drives is 7,200rpm, which is the minimum you should accept in a gaming drive.

Western Digital Caviar SE16 500GB

The new half-terabyte champion

Western Digital's 400GB Caviar is already our favorite 7,200rpm drive, so we expected big things from its new 500GB successor—and we were mostly satisfied.

The drive runs on a SATA 3G interface, sports a 16MB buffer, and uses four 125GB platters. This gives it a substantial areal-density advantage over its 400GB baby brother, which uses four 100GB platters. In drive comparisons, if all other specs are the same, the drive with the higher areal density will always be faster, because the read/write heads can pick up more data with less movement. And, indeed, we see that the 500GB drive has faster read speeds than the 400GB drive, while the performance of the two is essentially equal in all other benchmarks.

The 500GB Western Digital drive set a new benchmark record in *HD Tach*, with an amazing 62MB/s average read speed across its platters. However, it only equaled the 400GB version in all of our other "real world" benchmarks, which was a bit puzzling. Still, the fact that it performs as well as the fastest drive around *and* offers more capacity makes it good enough for us.

—Josh Norem

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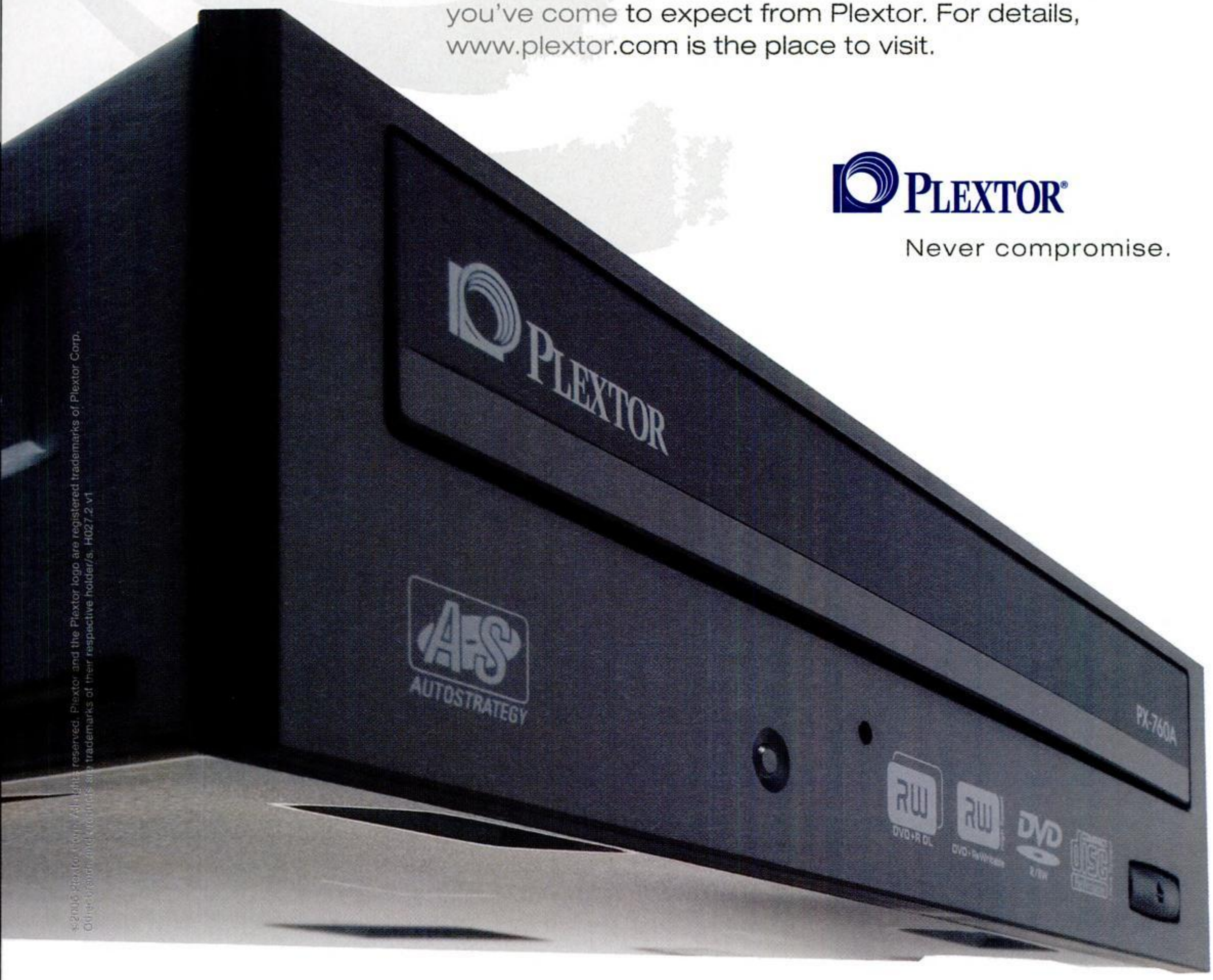

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DISPLAY BUYERS GUIDE

Pick the Perfect Display

Before you plunk down the cash for your next monitor, know which specs matter and which are bunk

SCREEN SIZE: This figure is the size of the LCD panel measured diagonally from corner to corner. Desktop screens range in size from 15 to 23 inches and beyond. We consider 19 inches the minimum for all-purpose computing. You need at least that much screen real estate to work in multiple windows comfortably, and to thoroughly enjoy high-definition video and PC games.

ASPECT RATIO: A display's aspect ratio is its screen width divided by its height. The majority of desktop monitors have an aspect ratio of 4:3, regardless of their screen size; and the majority of software applications and computer games are designed accordingly. This is something to bear in mind if you're considering a widescreen model, which typically has an aspect ratio of 16:9. If content, such as a game, insists on a 4:3 ratio, the display will stretch the content to fill the entire screen, making everything look fatter than it should. This situation is becoming less of a problem every day, as most games support at least one widescreen mode that won't look distorted.

NATIVE RESOLUTION: Every LCD sports a fixed number of pixels arrayed in a grid that is a certain number of pixels high and a certain number of pixels wide. The native resolution is the width of the display (in pixels) by the height (in pixels). The native resolution will deliver an optimum picture. While it's possible to run an LCD at a lower, non-native resolution, the image will be rescaled and the display will use interpolation to fill in the missing pixels, which can degrade image quality. Native resolution and interpolation quality are of particular concern to gamers, who often run games at low resolutions to get the best frame rate.

An LCD's native resolution is typically determined by its screen size. For example, many 19-inch monitors have a native resolution of 1280x1024, while many 20-inch models have a native resolution of 1600x1200. A higher resolution makes everything look smaller on-screen, but also gives you more space on your desktop.

INTERFACE: Today's LCDs connect to the graphics board via either an analog VGA connector or a digital DVI connector. If your graphics board is equipped with DVI outputs—most modern boards are—we recommend you use DVI to connect to your LCD.

Unlike CRTs, which must refresh every pixel on the screen 60-plus times a second, LCDs modify pixels only when they change. The analog connection is less precise because the digital information must be converted to an analog stream in order to travel to the LCD, where it is then analyzed and converted back to a digital format. This is a recipe for data loss or corruption in the image that is ultimately displayed on-screen.

CONTROLS: The degree to which you can adjust an LCD's picture via the onscreen display (OSD) varies among monitors: in some cases, you have fewer options with the digital interface because the manufacturer cheaped out. Adding hardware to the display that allows the user to manipulate the image detracts from the manufacturer's bottom line. We think it's important to have at least some control over color, brightness, and contrast.

PIXEL RESPONSE TIME: This spec has been getting a lot of play lately, so it deserves mention. A pixel's response time, measured in milliseconds, describes the time it takes for a pixel to change from its on state to its off state and then back on again. If the response time is too slow, you'll see ghosting and other artifacts because the display's pixels can't keep pace with the information sent from the graphics card. This problem is particularly noticeable in games, which tend to have fast action sequences.

A response time of 25 milliseconds was once the norm, but it's not uncommon these days to see response times listed in the single digits. As impressive as this spec sounds, it should be taken with a grain of salt. Different manufacturers report response times differently, so this spec isn't a reliable means of comparing different brands. Some vendors report only the pixels' rising (turning on) or falling (turning off) time; others report how long it takes for a pixel to turn on, turn off, and then turn on again; and still others report the time it takes for a pixel to go from peak white to full black. (Pixels change from white to black much faster than they change from gray to gray, but the latter is a much more common occurrence in real-world use.)

Because of this inconsistency, we don't normally report on a display's pixel response time, but we mention it here to illustrate a point: Response-time specs often do not jibe with qualitatively measured performance. The best way to determine an LCD's abilities with fast-paced content, in our opinion, is to eyeball it first-hand.

ERGONOMICS: Obviously, the more ability you have to adjust your screen's height, tilt, and orientation to fit your body, the better.

DISPLAY BUYERS GUIDE

Dell UltraSharp 2405FPW

It's as though someone took a rolling pin to our beloved Dell 2001FP 20-inch LCD and extended its proportions. The 2405FPW sports similar styling to its 4:3 kin, the same wide range of ergonomic adjustability, and a bounty of extras, including four USB 2.0 ports and a built-in 9-in-1 media reader.

OSD controls are up front and intuitive, and while some options are disabled with the digital interface, color-temperature presets and RGB sliders are fully functional. We like that.

Our infatuation was somewhat tempered when evaluating the 2405FPW's black level. LCDs are inherently challenged in this respect because of their ever-present backlight, but even with the brightness turned all the way down, the 2405FPW's black wasn't quite as dark or deep as in Samsung's 243T. Fortunately, the drop in brightness didn't diminish the distinction between black and dark grays.

In fact, the 2405FPW performed quite well in all of DisplayMate's gray-scale scripts, nearly matching the 243T's superb performance. The 2405FPW's only shortcoming was in the 256-step scales, where subtle signs of compression and expansion were evident at various steps. But unless you're doing exacting color matching, you probably won't notice this issue in real-world use—we certainly didn't when viewing digital images, DVDs, and games. All of the above looked gorgeous on the 2405FPW's ultra-expansive screen.

For the amount of screen and other goodies Dell's 2405FPW offers, its low price seems almost criminal.

Indeed, despite the 2405FPW's minor foibles, we're declaring it the winner in this contest. The 2405FPW might not have as strong a black level or as exact a grayscale as Samsung's 243T, but it tops that monitor by offering more image-adjustment options, a slew of inputs, and a picture-in-picture feature—all at an unbelievable price.

— Katherine Stevenson

DELL ULTRASHARP 2405FPW
$960, www.dell.com
9 MAXIMUM PC KICKASS

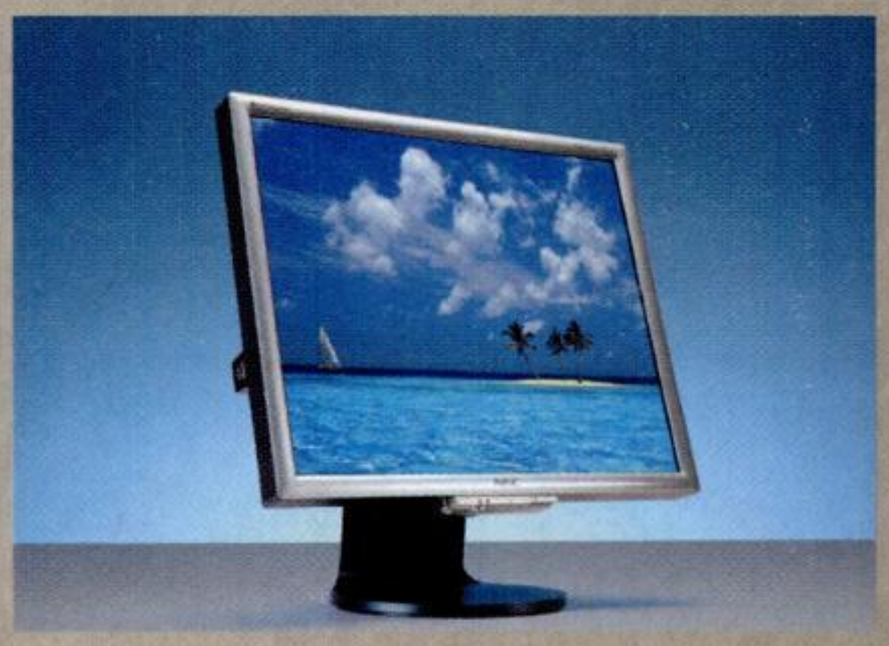
NEC 90GX2

This 19-inch LCD shines with games—literally!

The first thing you notice about NEC's 90GX2 is its glossy screen. It stands in stark contrast to the Samsung and Dell monitors, which are both treated with anti-glare and anti-reflective coatings (as are the majority of LCD screens). These coatings give displays a flat, matte finish that doesn't reflect light. The benefit of NEC's so-called OptiClear technology is that the screen's high sheen intensifies colors and contrast, producing a much more brilliant, vivid picture. Of course, such a screen is not suited to all environments. In our Lab, for instance, the bright overhead fluorescent lights created distracting reflections on the 90GX2's mirror-like surface, and even in lower-light situations, you might notice ambient reflections in large swaths of dark color.

But this isn't likely to dampen most home users' appreciation of the screen's vibrancy. During our testing, the 90GX2 certainly stole the show in the entertainment and desktop applications. Computer games in particular had extraordinary visual panache, and the screen was free of any signs of ghosting during fast-motion sequences.

The 90GX2 isn't flawless, however. The backlight is visible around the perimeter, especially on a primarily dark screen. And in DisplayMate we observed subtle color-tracking errors in grayscales of 64 steps or more (characterized by varying tints throughout the steps of the scale), plus some compression at the dark end of scales consisting of 128 or more steps. But these issues are of more concern to a user whose work requires precise color matching. As we said before, in our experience with a broad range of content, the 90GX2's picture is exceptional.



NEC's 90GX2 glossy, vibrant screen is known to stop passers-by in their tracks.

Like Samsung's 970P, the 90GX2 features a number of color-and-brightness presets intended to enhance various types of content—photo, movie, games, and so on. Unlike the 970P, however, you can switch among these offerings through the OSD buttons on the monitor's bezel. Sadly, the NEC doesn't have any built-in mechanism for height adjustment or screen rotation, although it does offer four powered USB 2.0 ports (along with analog and DVI inputs), which we like. And neat freaks might dig this display's cable-management system, which lets you run your signal, power, and USB cables discreetly through the monitor's neck (which has a detachable back).

— Katherine Stevenson

NEC 90GX2
$500, www.necdisplay.com
9 MAXIMUM PC KICKASS

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Pick the Perfect Case

Make sure you give your components a happy home

Though most people upgrade videocards and hard drives on an annual basis, they rarely upgrade their PC case, unless tragedy strikes. The reason is simple: The ATX specification for cases has been around a long time, and it's still getting the job done. Simply put, there's usually little reason to upgrade unless you're looking for more room, more cooling or a more pleasing aesthetic. Indeed, these are the most important characteristics of a case: it must be able to hold all your hardware, and have enough fans to keep everything cool and relatively quiet.

CASE FANS: All cases include some sort of cooling system, though whether or not the actual fans are inside the case at the time of purchase varies. Regardless, every case has fan mounts, and it's important to see what size they are prior to purchase. We typically favor large 12cm fans because they spin slowly, and therefore are relatively nice and quiet—and move a lot of air. You'll want to make sure there's a fan in the lower front of the case to suck air into the PC, and a nice, big fan in the back to blow it out. Some fans include exhaust fans on the top or side of the case, too, but these aren't always necessary and can add a lot of unwanted noise.

FORM FACTOR: The lion's share of consumer-level motherboards conform to the ATX specification, so make sure the case in question supports this standard (most do). Once you know it supports ATX, the only big question left is, How big do you want to go? There's mid-tower cases, which are the size of what most consider to be a "regular" desktop, and there's full-tower cases, which are much larger and longer than a mid-tower. Though their size makes them unsuitable for frequent transport to LAN parties, full-size towers are a breeze to work in given their cavernous interiors. They can also hold a lot of hardware, which is nice if you have several hard drives, are running SLI, or are thinking about investing in water cooling. For most users, however, a mid-tower will be more than sufficient.

FRONT-MOUNTED USB: This feature—having USB ports mounted on the front of the case for easy access—used to be a delicacy, but it is now almost standard fare. Still, pay attention to their location, as sometimes they're on the bottom-front of the case, and other cases put them right at the top, which is nice if your PC is resting on the floor. Some also offer front-mounted audio jacks and FireWire, which may be important to you.

COOLER MASTER CM STACKER 830

Making the case for bigger, better, and ballsier

The original CM Stacker was so audacious that we wondered what Cooler Master would do to one-up it: Now we know. The follow-up—dubbed the CM Stacker 830—improves on the original design in every way possible, and is one of the most badass cases we've ever laid our grubby (yet grounded for static) hands on.

It's still made entirely of aluminum — old-school, Wave Master–style aluminum. It's thick, and feels incredibly solid. This is not a case that flexes when you sit on it, yet it's light enough that you won't inflame your hernia when you pick it up by the handles built into its top.

USB, FireWire, and audio ports are now on top of the case as well as in the front—a marked improvement. The internal audio cable that dangles from the connector sports four plugs to ensure compatibility with every kind of audio jack on the market. The case still boasts 10 5.25-inch bays, and you can fill them with whatever you want—including optical drives, fan buses, and the included 3.5-inch drive cage, though the latter holds only three drives. If you have more drives than that, you'll have to purchase a 5.25-to-3.25-inch adapter.

Perhaps the biggest improvement to the Stacker is in the cooling department. The case's included hard-drive cage has its own dedicated 12cm fan, but you can also mount two more 12cm fans in any remaining empty 5.25-inch bays. Cooler Master includes an adapter for only one additional fan.

Where the case gets insanely cool is with the swing-out, removable side door that hides behind the left-side panel. It can hold up to four 6cm to 12cm fans, and if you're not using it, you can simply remove it with the push of a button. The case is completely tool-less, though you will have to attach the hard drives to their cage via screws. And the Stacker supports all current mobo form-factors.

COOLER MASTER CM STACKER 830
$250, www.coolermaster.com
9
MAXIMUM PC KICKASS

CASES BUYERS GUIDE

A Tale of Two Towers

Delectable cases, from both sides of the tracks

Do you roll like a lottery-winning balla', or more like a college freshman working part-time at the Qwickie-Mart? Either way, we have a case for you this month. Both of these enclosures are dark, mysterious, and praiseworthy, despite the fact that you can buy five of one for the price of the other.

KINGWIN SK-523BKW

Don't let the uninspired name fool you: Kingwin's SK-523BKW is one of the best enclosures we've seen at this price. Thanks to its all-steel body and aluminum front bezel, the SK-523BKW is light yet feels sufficiently sturdy when you're working in it. The front bezel features a swing-out door that's bathed in the soft glow of an integrated red cold-cathode light. On the right side of the bezel, a small door flips open to reveal two USB ports and a single SATA port, which you can connect to a SATA port on your mobo using a pass-through cable. It's not useful now, but it could be if external SATA catches on.

The interior of the chassis is identical to the excellent Cooler Master Cavalier, with one exception: The three-drive hard-drive cage is turned sideways, so the back of the drives face the side door, making drive swaps incredibly easy. Snap-on drive rails that are a snap—literally—make swapping disks even more effortless. Sliding levers lock optical drives into place, and PCI cards are secured via a nifty tool-less retention mechanism.

The included fans—two big, quiet 12cm jobbies—intake and exhaust more than enough air, and operate quietly to boot. You can even adjust the front fan's speed using a knob on the front bezel.

As far as we're concerned, the SK-523BKW's only flaw is its paint job: The flat black finish is much too scratch-prone. A videocard we set on top of the case in the course of our tinkering might as well have been a feral cat, so severe were the resulting scratches.

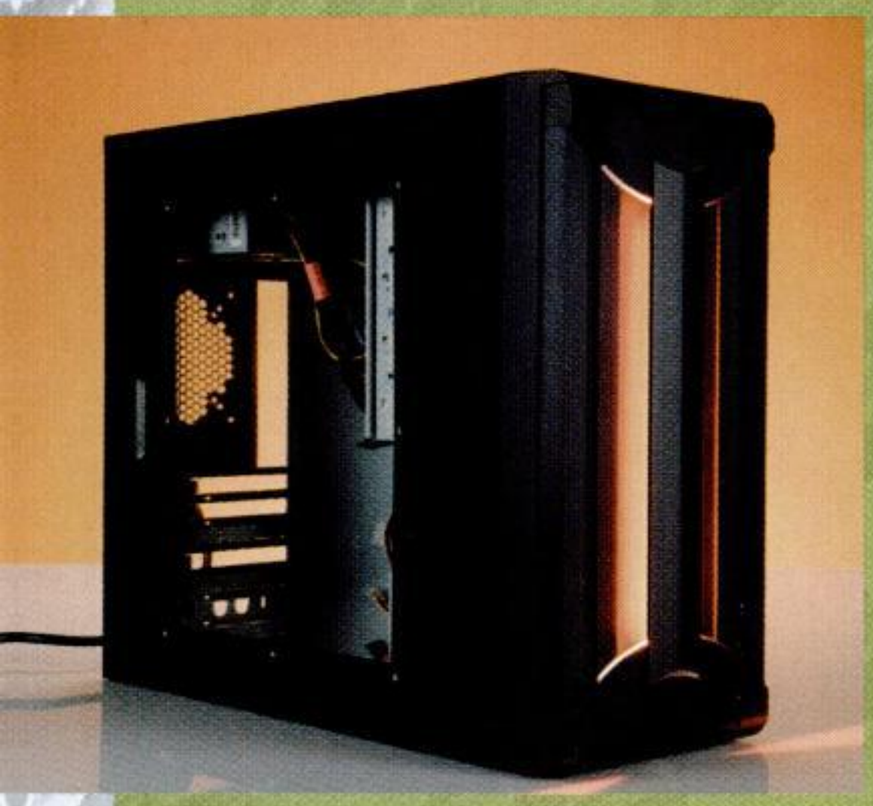
KINGWIN SK-523BKW

+ COLD CATHODE
Good cooling, sleek design, and easy to build in.

− COLD CASSEROLE
Exterior scratches easily, and cold cathode light is bright.

9

$55, www.kingwin.com



In what will probably become a trend in the future, Kingwin includes a front-mounted SATA port along with USB.

LIAN LI PC-777 MEMORIAL EDITION

We were initially taken aback by the PC-777's unusual snail-shell design—an aluminum representation of Lian Li's corporate logo. But we have to admit that it's grown on us, especially the black version, which we reviewed (silver is also an option). Regardless of where you stand on its looks, this case is another outstanding creation from Lian Li, offering a roomy interior, silent cooling, and exquisite craftsmanship.

At a whopping 25 inches tall, the PC-777 is frickin' mammoth. (Senior Editor Gordon Ung calls it "old-school huge.") Despite its all-aluminum construction, the case feels very sturdy and stout. You can glimpse your PC's innards through the case's mesh side doors, which greatly aid ventilation. A single thumbscrew holds each door in place, so you can get at your hardware in mere seconds. The required USB, FireWire, and audio ports are located on the top edge of the case's bezel.

Uncertain at first, we grew to appreciate the unusual snail-like design of Lian Li's Memorial Edition.

In a case this big, we'd expect plenty of room for all our hardware, and that's exactly what we got. A side-facing cage holds up to six hard drives. Each drive slides into its bay easily and is locked into place with small tabs. Above the hard drives are six 5.25-inch bays, suitable for optical drives. (The case even includes a black cover for the upper-most drive so your beige DVD burner won't sully your slick rig.) There's a silent 12cm intake fan in front of the hard-drive bay, and another silent 12cm exhaust fan. While the cooling is adequate, an emphasis on quiet operation minimizes the amount of air moving inside the chassis. If you're going to use water-cooling in this case, you'll need to make provisions for more airflow.

All in all, the snail is one hell of an enclosure. It's Lian Li quality all around—stylish, functional, quiet, and well-made.

LIAN LI PC-777 MEMORIAL EDITION

+ ESCARGOT
Exotic, huge, and quiet.

− ESCAROLE
The fans are quiet, but they don't move much air.

9

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Sound Advice

Do you still need an add-in soundcard?

Last year Intel introduced a new spec called HD Audio that could be the soundcard's death knell. HD Audio is a major revision to the AC97 audio spec that's been powering most onboard audio since 1997. HD Audio ratchets up the components from AC97's 16- to 18-bit parts to full 24-bit with up to 192kHz sample rates, which delivers audio that's on par with today's best soundcards (in specs, anyway).

HD Audio also happens to find a really good use to keep your CPU busy. Currently, when you plug your PC into your home-theater audio system using a digital SPDIF or optical cable, the only time you can get true digital surround sound is with DVD movies on your PC. Gaming, and any other application where sound is created on the fly, is stereo-only. HD Audio gives motherboard vendors the option of running Dolby Digital Live, which takes the surround-sound audio from a game and encodes it in real time to a format that your home-theater receiver can understand.

There is a catch. Even though the best HD Audio components are 24-bit, they must still be mounted on a motherboard, which subjects the audio to all sorts of electrical interference, or "noise."

Also, while add-in soundcards such as Creative Labs' Audigy 2 ZS and new X-Fi use their own digital signal processors (DSP) to perform audio chores, HD Audio uses your CPU. The sound of a bullet zinging over your head, for example, requires calculations to add a Doppler effect or echo. With just about all of today's onboard audio, the CPU must calculate the sound effect. Most hard-core gamers believe that any time the CPU's attention is diverted, frame rates go down. That's generally been true, but much of that thinking evolved in the days of the 400MHz Pentium II processor.

So does that mean Intel has finally put the last nail into the soundcard's coffin? No. Soundcards still offer higher-quality audio because the components are elevated off of the noisy motherboard. Plus, features such as DVD Audio are only available with a soundcard because of copyright issues. And while many people will be content to lose 5 percent of performance using onboard audio, many hard-core gamers won't give it up.

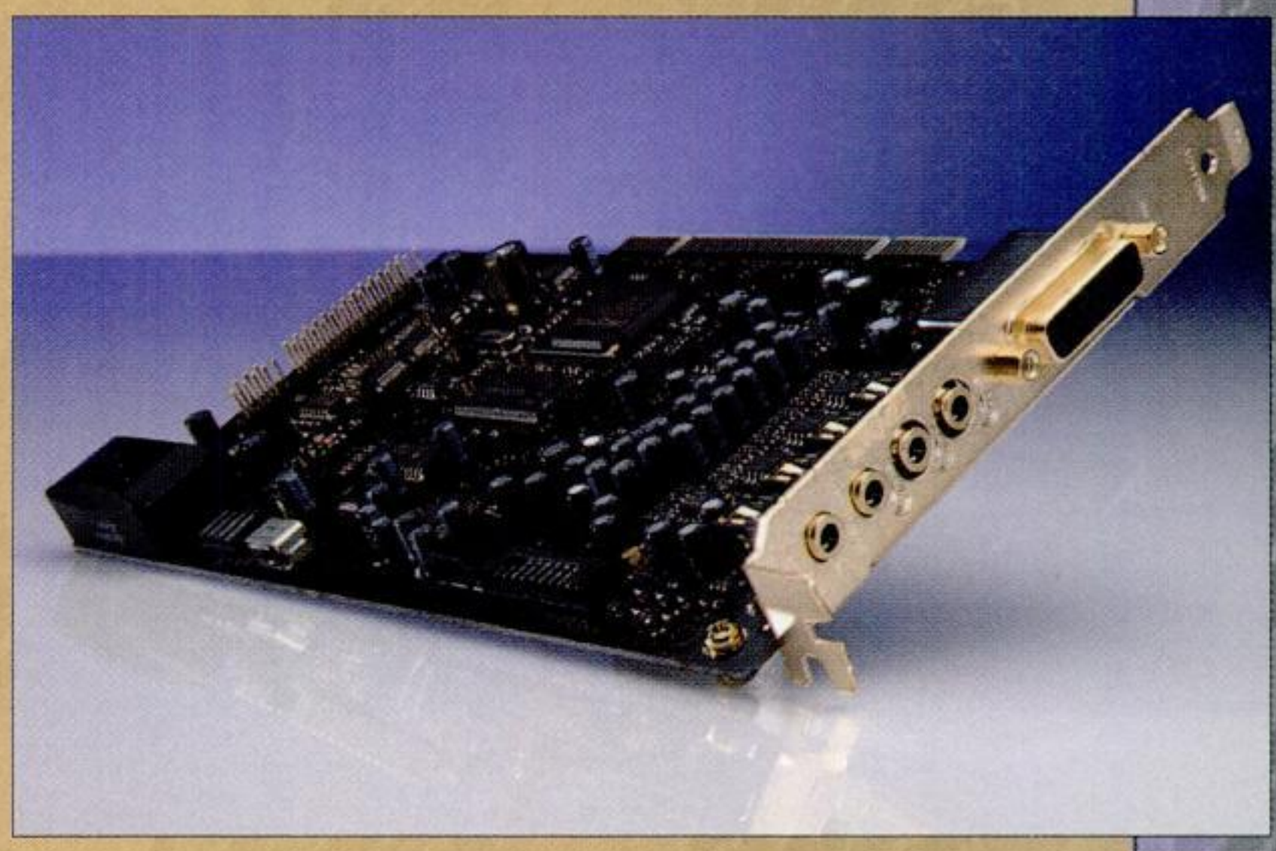
CREATIVE LABS SOUND BLASTER X-FI

With its 400MHz core speed, 51 million transistors, and 10,000 MIPS, the X-Fi, according to Creative, has 24 times the power of an Audigy 2 ZS and equals the power of a 3.4GHz general-purpose CPU.

Creative is building the X-Fi into three distinct PCBs, with four versions of the card available at retail. The basic X-Fi XtremeMusic features a multichannel 24-bit Cirrus Logic DAC, a Wolfson 24-bit ADC, and 2MB of "XRAM." The X-Fi Platinum adds a bay adapter to the XtremeMusic's mix. The Fatal1ty FPS uses the same DACs as the XtremeMusic but ups the XRAM to 64MB and gives you a status LED. (What's XRAM for? It will act as a local audio buffer eventually, but right now, it doesn't do much.) All three can hit 109dB SNR, which is just a tick better than the 2 ZS' 108dB. Finally, the Elite Pro can hit 116dB thanks to its higher-end AKM DAC.

In music, movies, and games, the X-Fi sounded better than HD Audio. In Battlefield 2 with HD, comm chatter sounded synthetic and the positional effect was poor. With the X-Fi, a tank's engine rumble was occluded when it moved around a corner to the other side of a building. Furthermore, we experienced actual game hitches in Battlefield 2 with HD Audio; with the X-Fi, there were none. With the X-Fi, you get better audio and frame rates.

The X-Fi isn't perfect. We're disappointed we can't tune headphone acoustics like we could on many Sensaura parts. On the base XtremeMusic card, you can't even program the jacks to support headphones and speakers simultaneously. And we definitely don't think the extra RAM and pointless LED in the Fatal1ty FPS card are worth extra cash.



Still, it's hard to foresee anyone making a better all-purpose soundcard than the X-Fi series in the near future. Despite predictions of its death, it's pretty clear to us that the soundcard is still alive and kicking. MPC

CREATIVE LABS X-FI
$130, www.soundblaster.com
9
MAXIMUM PC KICKASS

BUILD THE Perfect PC

Our hand-built rig rips through today's games and has plenty of room for upgrades, all for the price of a single Athlon FX-60 CPU! Build one for yourself today with our in-depth, step-by-step guide.

BY JOSH NOREM

MONTH IN AND MONTH OUT, WE sing the praises of all-out, overclocked rigs of destruction fit for a prince. And you love it! And yet one of the most common requests we get from readers is for system configs that a pauper can afford. After all, not everyone has the financial means to build or buy a PC that costs as much as some cars.

So we put our heads together and came up with the ultimate budget PC—for gamers. We set our budget crazy-low: $1,000. Consider this rig a "tweener" machine: It's got what it takes to play all of today's current titles—including *Quake 4, Doom 3, F.E.A.R.,* and *Battlefield 2*—at respectable frame rates and resolutions, but it also provides plenty of room for upgrades. (For example we show you how to add a second videocard with SLI and add-in sound in the build-it section—for just another $300.) This will make sure you're not left out in the cold when next-gen games such as *Crysis* start arriving later this year.

Building a budget PC is never easy because you have to make compromises. The key to satisfaction is to identify the system's primary purpose and then spend as much as you can to bolster that one area of performance. Because we wanted a gaming PC, videocard and CPU performance were paramount. We went with midrange products, but because we chose a Socket 939, PCI Express motherboard, we've got plenty of upgrade options. Moving from one to two videocards is an obvious future step, and while AMD's top-of-the-line Athlon FX-60 costs $1,000 right now, by the time we'll need to upgrade, AMD will have moved over to Socket AM2 and FX-60s will be more affordable.

Read on for details of the full config, our step-by-step build guide, the benchmark numbers, and the other budget-minded components we'd pair this rig with.

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PHOTOGRAPHY BY SAMANTHA BERG

Our Budget Badass

Sure, it's no Voodoo system, but this rig offers gaming muscle, upgradeability, and invaluable DIY pride

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Case/PSU: Both of these components are awesome, despite their low price. Kingwin's case has ample cooling and is super-easy to work in. We coupled it with Antec's SLI-capable 550W TruePower 2.0 PSU. The TruePower delivers more than enough power for our needs now, and it will still suffice if we add a second videocard.

Motherboard: The foundation for the whole shebang is Asus' excellent A8N-SLI Deluxe. This formerly high-end board can now be found for an eminently affordable $110. It's SLI-capable, rock-stable, and offers plenty of overclocking options.

CPU: The brains behind the whole operation is AMD's Athlon 64 3700+. It rings in at 2.2GHz, which we overclocked to 2.53GHz (bargain-bin chips usually overclock quite well). With 1MB of L2 cache, it's certainly not gimped. We briefly considered going with a dual-core X2 3800+ proc, but at $300 it was just too pricey.

Videocard: Pumping the pixels is nVidia's new middleweight champion—the 7600 GT. This card impressed the hell out of us, besting the former budget champ—nVidia's 6800 GT—by a healthy margin. It's SLI-capable, which you'll see in the build guide, and doesn't even require external power!

Hard drive: The WD2500KS is a shoe-in for a budget box because it's blazing-fast at a low, low price. It's got 250GB of storage, a fat 16MB buffer, a SATA 3G interface, and cool operation, so the only compromise we're making here is capacity.

Not shown: Optical drive. See the spec list for details.

The Specs

CPU: AMD Athlon 3700+
$230, www.amd.com

RAM: 1GB Corsair PC3200
$75, www.corsair.com

Videocard: nVidia GeForce 7600 GT
$225, www.nvidia.com

Hard drive: Western Digital Caviar SE 16 250GB
(Model #: WD2500KS)
$110, www.wdc.com

Mobo: Asus A8N-SLI Deluxe
$110, www.asus.com

Optical drive: BenQ DW1655 w/LightScribe
$55, www.benq.com

PSU: Antec TruePower 2.0 550W
$115, www.antec.com

Case: Kingwin SK-523BKW
$55, www.kingwin.com

Total: $975

In our build guide we add two upgrades: a second 7600 ($225) and a Sound Blaster Audigy 2 soundcard ($75, www.creativelabs.com). These extras bring the total to $1,275—but you can always add them later if you're on a tight budget.

Continued on page 44→

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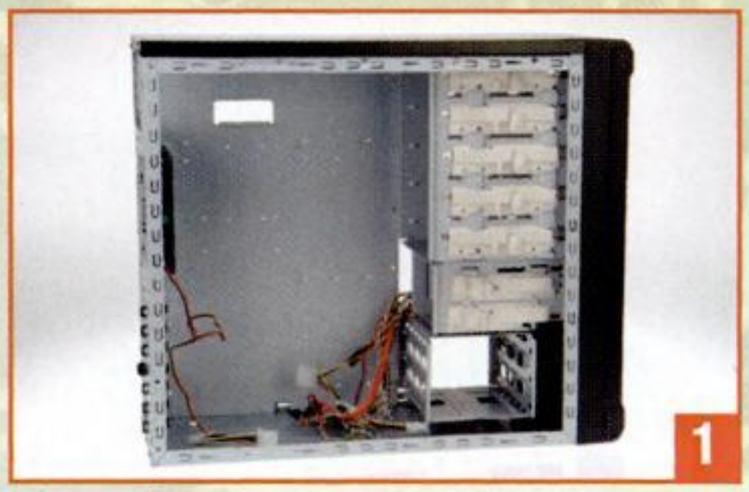
Continued from page 43

STEP 1: Prep your case

Most PC cases come with a fair amount of hardware. Everything from specialized standoff mounts that will keep your mobo at just the right height, to front-mounted USB ports, to the proper screws for mounting fans, should be in a box inside your case. Before we can get started, you'll need to remove your case door and pull out that box of hardware. Got it? Great!

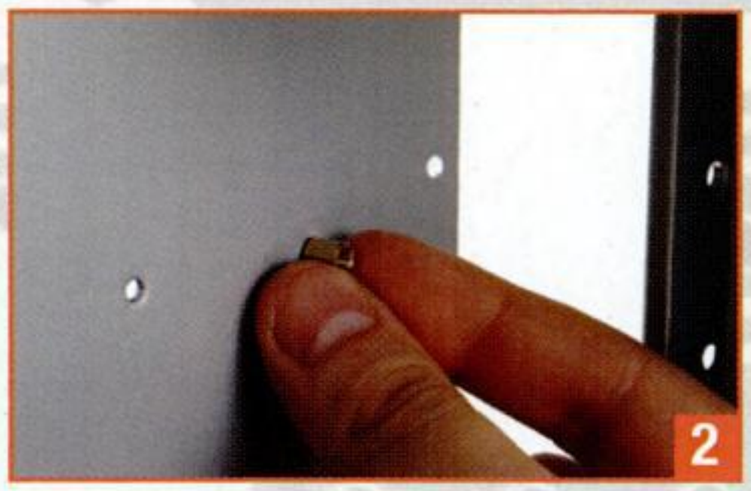
Since you're going to lay the case down on its side to work, it's a good idea to take off both side panels. Taking off the case doors prevents you from scratching them while you install the rest of your gear.


1

STEP 2: Prep your mobo

In order to mount your motherboard in the case, you need to first install motherboard standoffs. (If your case has a motherboard tray, you'll have a much easier time if you remove the tray from your case.) Each motherboard has a slightly different standoff config, so hold the mobo up to the tray and note which holes on your mobo line up with the holes on the tray.

It's vital that you not put extra standoffs in the case that don't align with holes on the mobo. The extra standoffs can short contacts on the back of the mobo, and render your whole system unbootable—or cause permanent damage to your hardware.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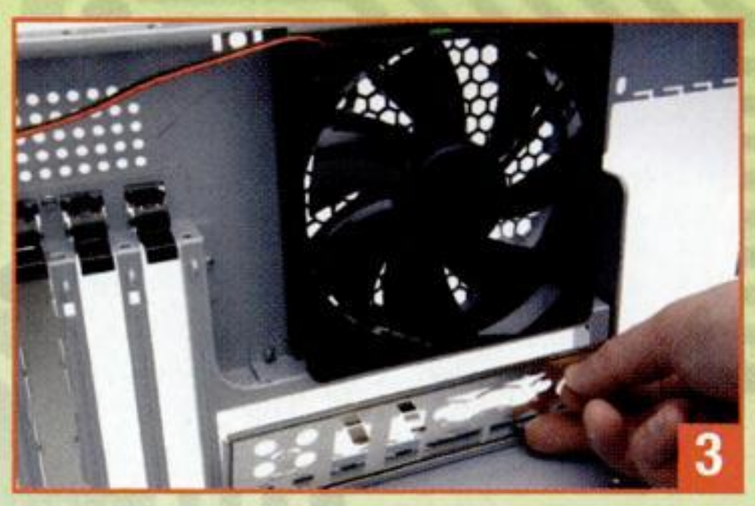
STEP 3: Install the backplate

Because there are dozens of possible configurations for the ATX backplate—the thing on your mobo with holes for the PS/2, USB, serial, parallel, network, and even FireWire connectors—each motherboard comes with a custom plate, which pops into a standard-size hole in your case. It mounts from the inside, so you'll need to line it up with the hole and pop it into place. Make sure that it faces the right way: Usually the PS/2 ports go nearest the power supply.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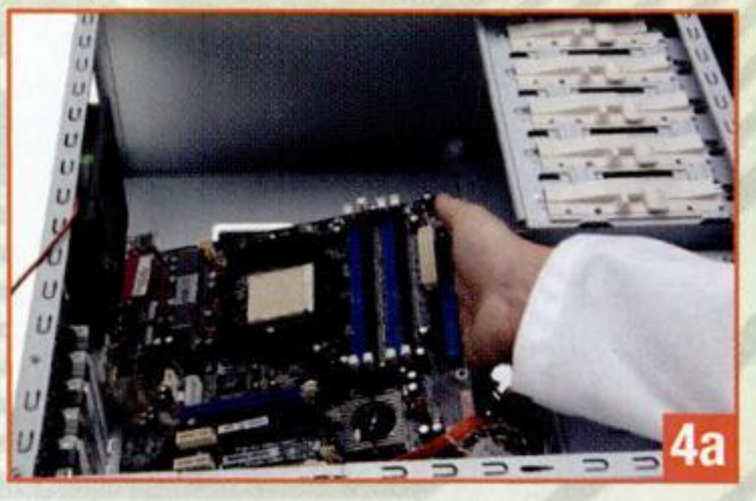
STEP 4: Mount the mobo

To mount the mobo, line up its rear connectors—the PS/2, USB, and other ports—with the holes in your ATX backplate, and slide the mobo into the case at a 45-degree angle (a). Once the port connectors have lined up with the backplate, lower the front edge of the mobo. Once that's done, screw down the mobo (b). Be careful not to strip the screws: A good practice is to reverse each screw one-quarter of a turn before you begin screwing it down.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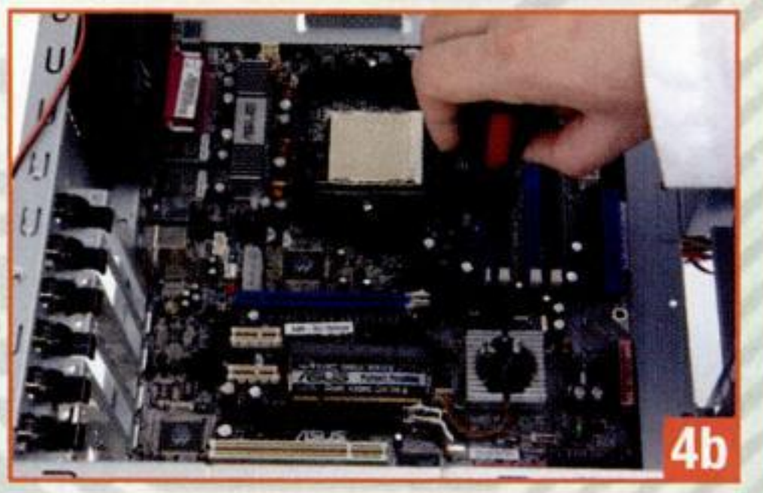
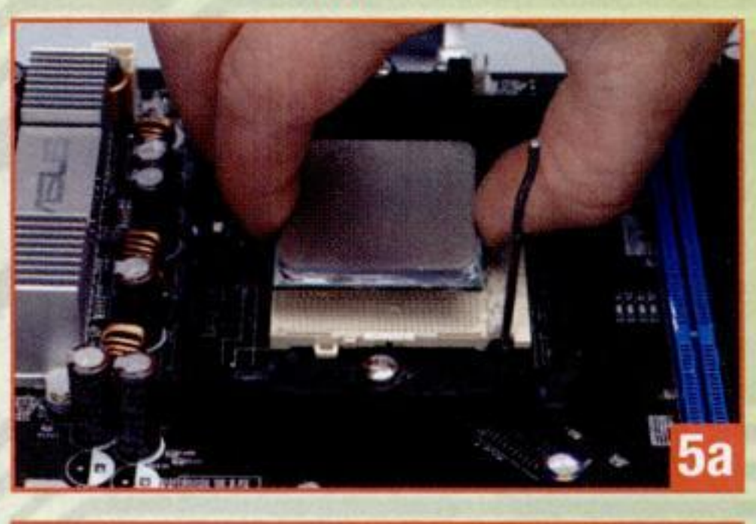

4b

STEP 5: Socket your processor

This is the most delicate part of your installation, so take your time. Make sure you're grounded before you handle the CPU (simply touch a metal portion of the case before you pick it up), and we can get started. (For old-style Athlon and Pentium 4 processors, the procedure is the same. If you have a new Intel LGA775 processor, check the sidebar on page 46.) First, you need to lift the little lever beside the socket. Next, line up the processor with the socket: one corner will be keyed, so that the proc can go into the socket only one way. Gently lower the chip into the socket (a). Make certain you do NOT apply any force to the processor—doing so can damage it permanently! It should drop into place. Once it does, you can lower the lever back down until it clicks.

Now you need to add thermal paste to the CPU (b). (If you're using a stock Intel or AMD heatsink, use the thermal pad that's provided.) Apply a thin layer of paste to your CPU's heat spreader. Smooth it down with a business card or other suitable trowel. Then affix the heatsink to the socket (c). Usually, this process is as simple as setting the heatsink in the socket, lining up a couple of clips, and snapping them into place. Now, verify that the CPU fan is connected to either the three-pin mobo header labeled "CPU" or to a four-pin Molex connector from your power supply (d).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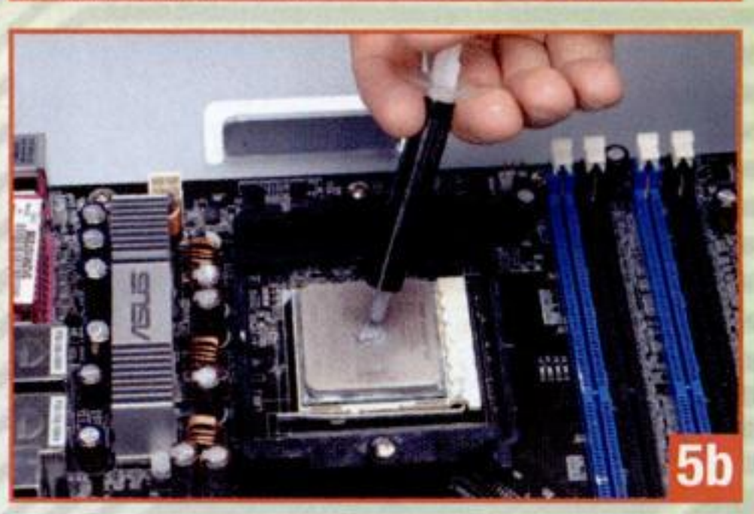
5b

Caution!

It's vital that you not put extra standoffs in the case that don't align with holes on the motherboard.

Continued on page 46→

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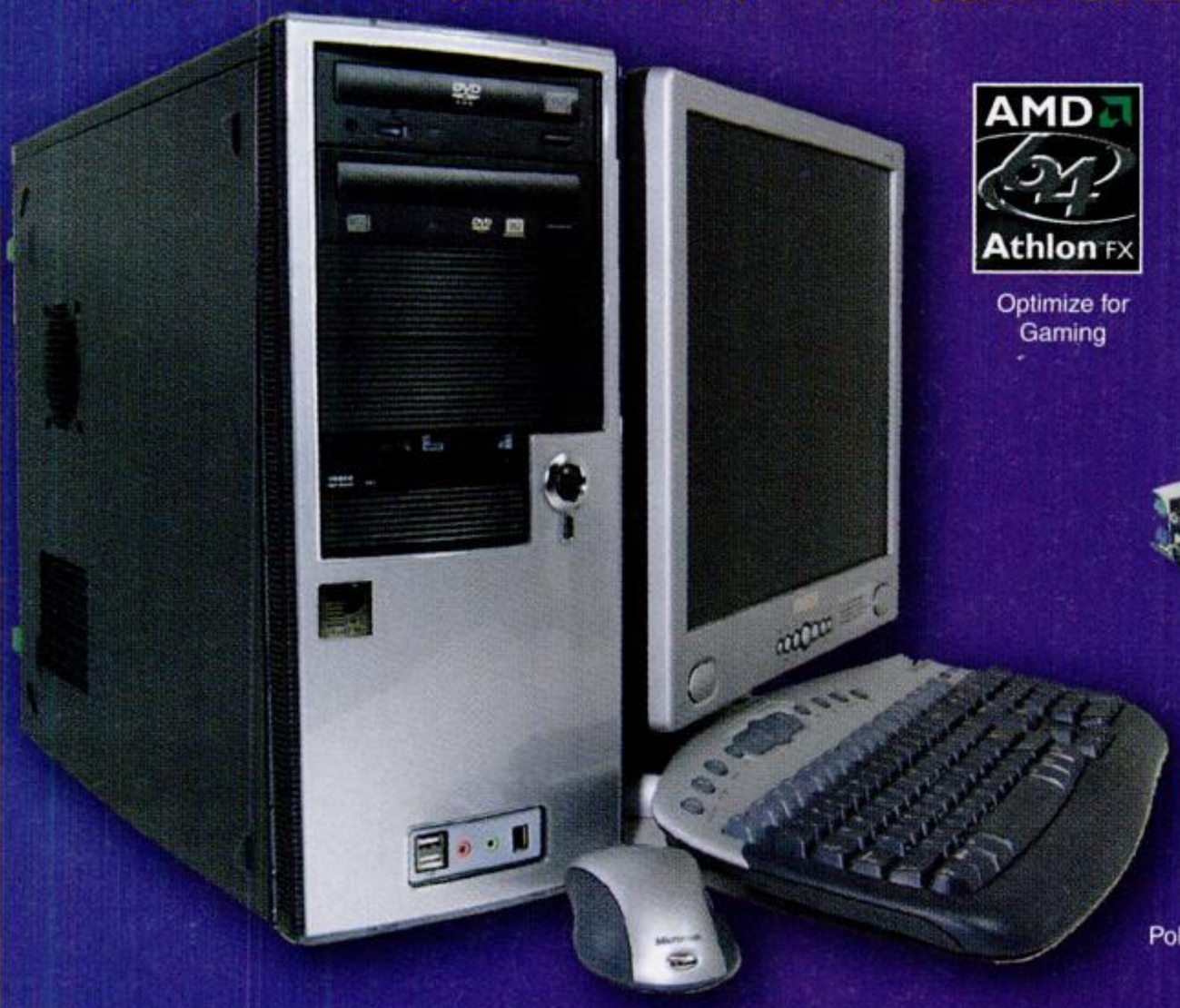

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*Enhanced Virus Protection is only enabled by certain operating systems including Windows and Linux. The model number indicates relative software performance among this AMD processor family.

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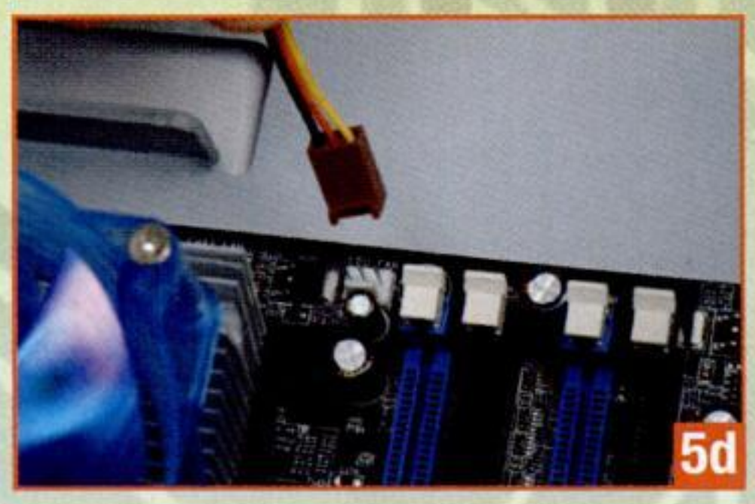
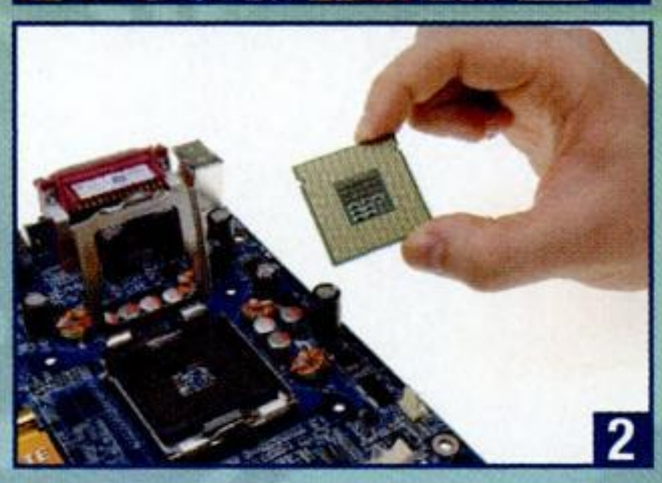
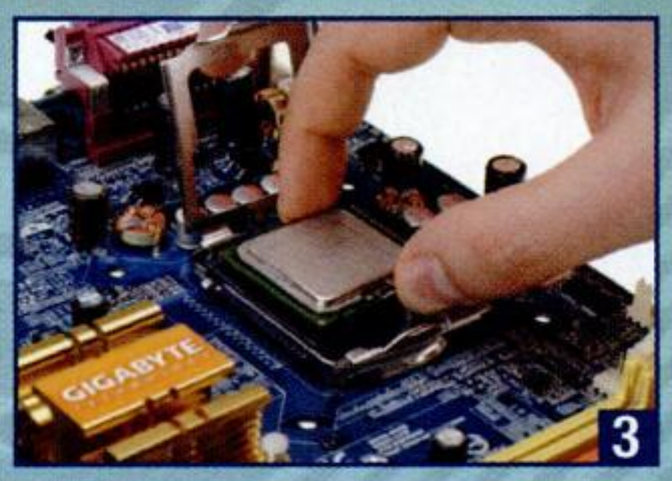


STEP 6: Don't forget memory!

Installing RAM is easy, but it requires more force than most people expect. To install memory, first consult your motherboard's documentation to determine which slots you need to put memory into to enable dual-channel mode. Usually they're color-coded, but this can vary among manufacturers. Once you know which slots to use, examine the RAM and the memory slot. Note that the sticks go in only one way. Line up the notch in the RAM stick with the key in the slot and then push down on the stick, applying even force to both ends of the stick until it clicks into place. Repeat with the second stick.

How to Install Your LGA775 Proc — the Right Way



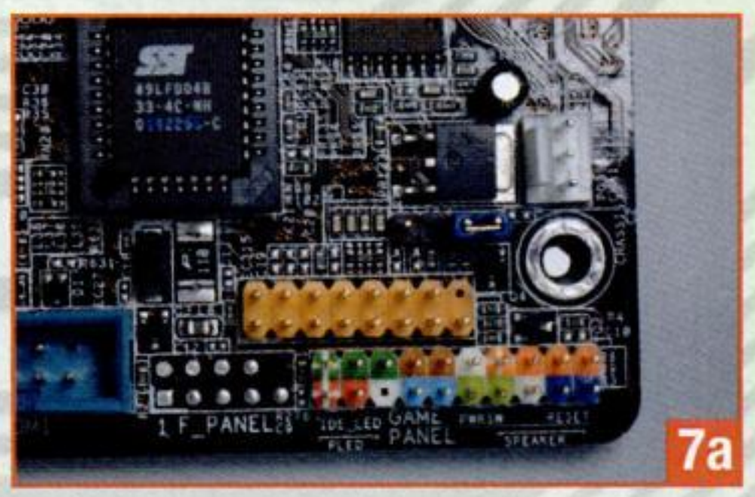


Much like your friendly *Maximum PC* editor, Intel's new LGA775 CPU interface is delicate and fragile. Read these instructions before you install yours to avoid permanent damage.

Intel's new LGA775 CPU interface is supposed to herald a new era of performance by eliminating the need for pins in the CPU and reducing resistance. Unfortunately, because LGA775 moves the fragile pins to the motherboard, the socket's official lifespan is a meager 25 insertions. Because the new socket is so delicate, you need to finesse it.

Before you handle a processor, make sure you're grounded. Unlock the socket lever on your new motherboard and flip open the load plate. You should notice a plastic cover on the metal load plate. Remove this plate and keep it somewhere safe (1): If you need to ship the board without the processor in it, this cover will provide protection. (Some motherboard vendors, in fact, will honor RMA only if you ship the board with this cover.)

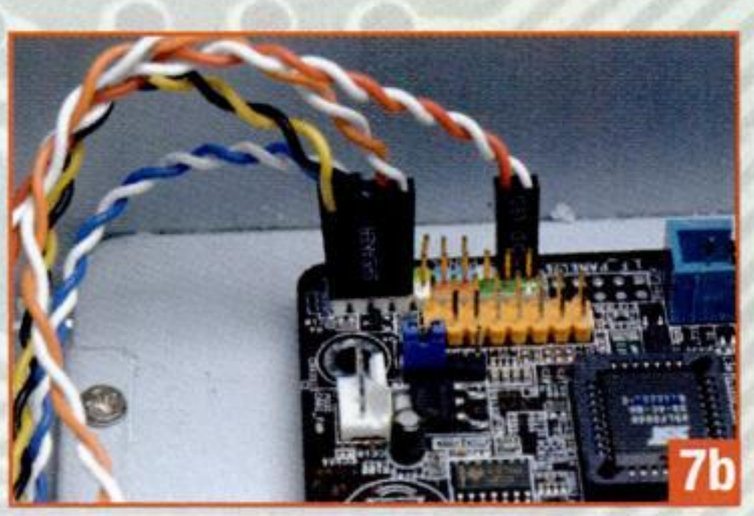
Pick up the CPU with your thumb and index finger (2) and carefully align it with the notches in the socket. Insert the CPU straight down into the socket (3). Be careful not to slide or drop any part of the processor when you seat it—doing so will bend the pins! Once the CPU is seated and the notches match, put the load plate down and lower the socket lever. You're good to go.



STEP 7: Arm the switches

Now you need to connect your case's buttons and lights to your motherboard. You'll need to consult your mobo's manual again, as each motherboard is different. Connecting the headers, which run from the case to the mobo, is as simple as lining up the pins—they're color-coded for each type of connection (power, reset, LED, and so on) (a)—and applying a tiny amount of force until the wire slides into place (b).

All you really need to get your system up and running is the power-switch connector, but don't be a half-ass. Once you've connected the reset and power switches, it's time for the lights. It doesn't matter which wire goes to which lead for the switches, but the lights require proper polarity. Your mobo manual will tell you which of the pins is positive; usually the wire that's colored is the positive lead. If you get it backward, don't worry.



STEP 8: Power external peripherals

Connecting USB and FireWire ports is simple. Today, case enclosures include pre-configured connectors for each type of port. All you need to do is line up the connector with the header on the mobo and gently push down. Both FireWire and USB cables are keyed so they won't go in if they're not lined up properly.

Occasionally, you'll find a case where the USB cables aren't in a convenient connector block; instead, each wire is separate. If that's the case, your mobo manual should include a pin-out diagram that will show you how to connect the wires.

Make absolutely certain you don't switch the USB (a) and FireWire (b) headers—it's not always easy to tell the cables apart. Consult your case manual if you're not

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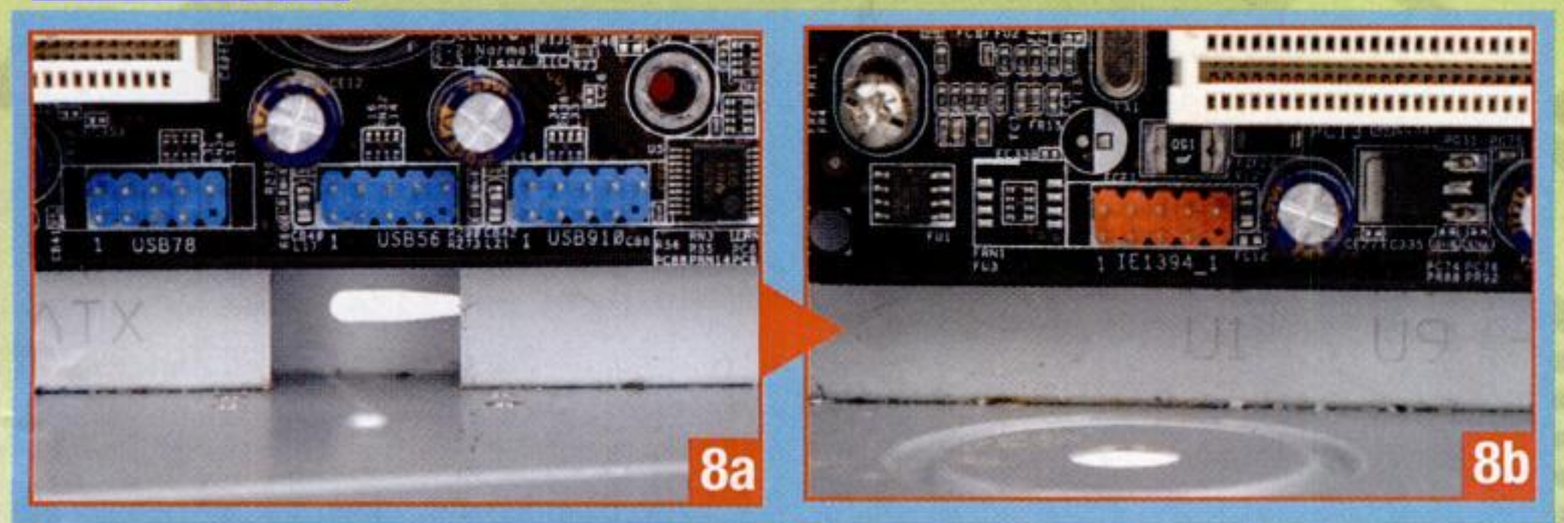
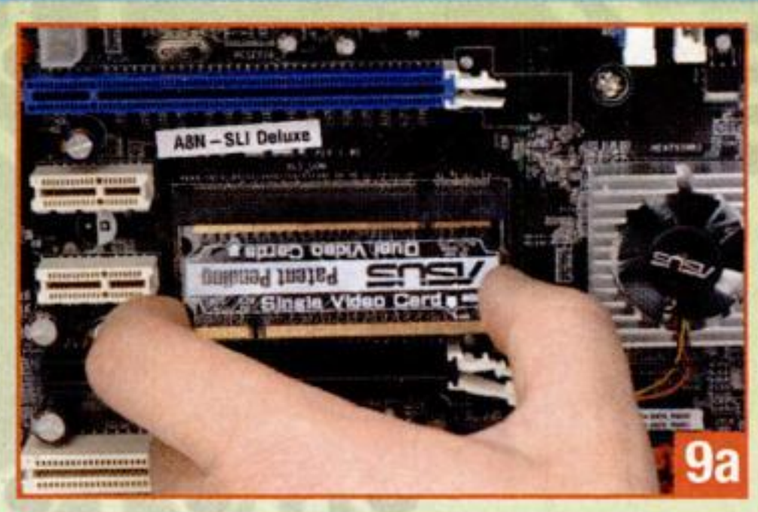


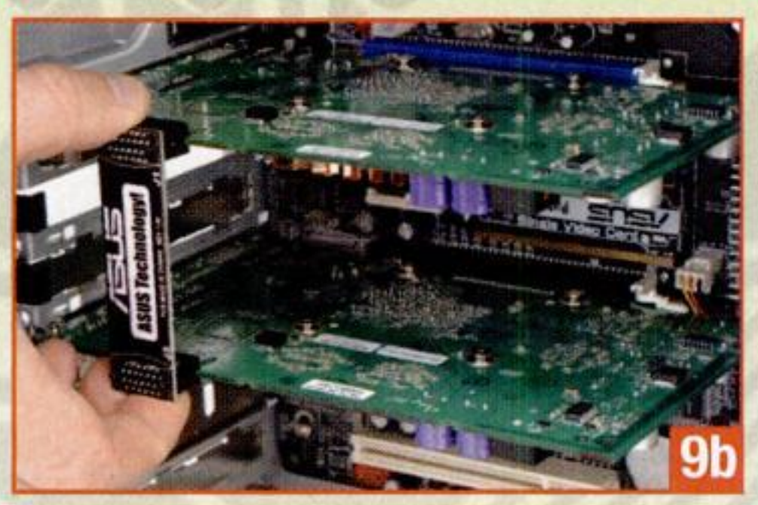
positive which is which. If you make this mistake and then plug a device into the wrong port, you can destroy both the device and the motherboard you're connecting it to!

Many motherboards lack onboard headers for front-mounted FireWire, but there's an alternative. Most Sound Blaster Audigy 2 cards include internal FireWire headers. When you install the soundcard, just slip your FireWire cable onto the header at the top of the PCI card.

Caution!

If you plug a FireWire device into a USB bus, you can destroy both the device and the motherboard you're connecting it to!





STEP 9: Install the videocards

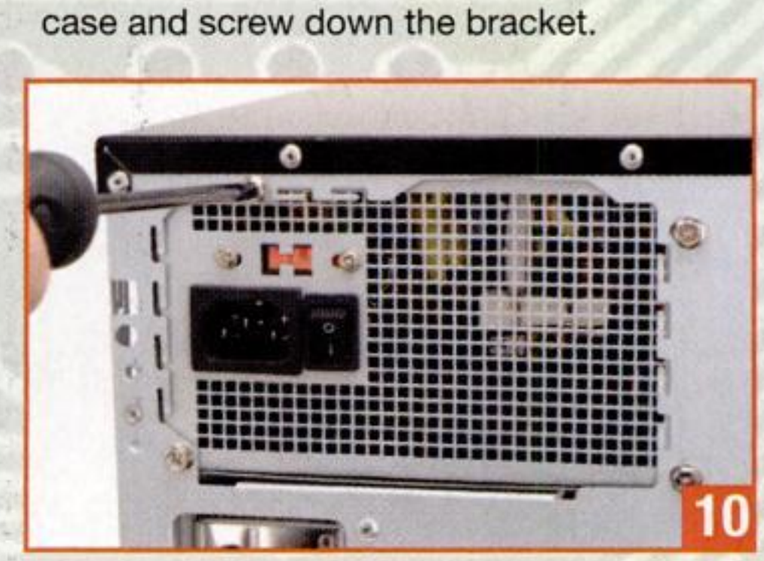
Before installing a videocard, you need to know whether you will be running a single card or dual-cards in SLI. The reason is that this board, along with most older SLI boards, has a single- or dual-card switch on the motherboard that must be set correctly. On this Asus board, it's a little card that must be flipped to enable either setting. However, this mechanism varies from mobo to mobo, so consult your manual. On our Asus board, its default setting is for single-card. If you're running one card, just plug it into the slot carefully, applying firm and even pressure. If you're running two cards, before you insert the first card remove the SLI jumper card from the slot, reverse it to "dual video cards" and push it into the slot (a).

Insert the first card into the PCI Express slot. Next, insert the second card into the PCI Express slot below. If there is an auxiliary power connector for SLI around the videocard PCI slots on your mobo, be sure to plug it in as well. Finally, connect the two cards via the included SLI bridge connector. Its orientation doesn't matter, so just push it down over both cards' SLI connectors until it's very snug (b).

STEP 10: Add power

If your case doesn't come with a power supply, you need to install the one you bought. Usually, there's some sort of mounting bracket screwed into the back of the case. You need to unscrew the bracket before you can mount the power supply to it. Make sure you pay attention to the way the bracket was on the case before you removed it: The entire assembly goes on only one way. If you flip the bracket over, it just won't mount properly.

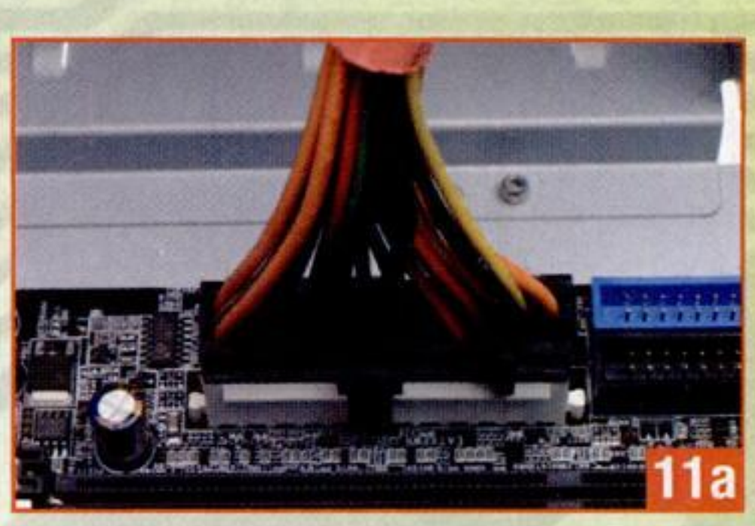
Once the PSU is attached to the bracket, slide the power supply into your case and screw down the bracket.

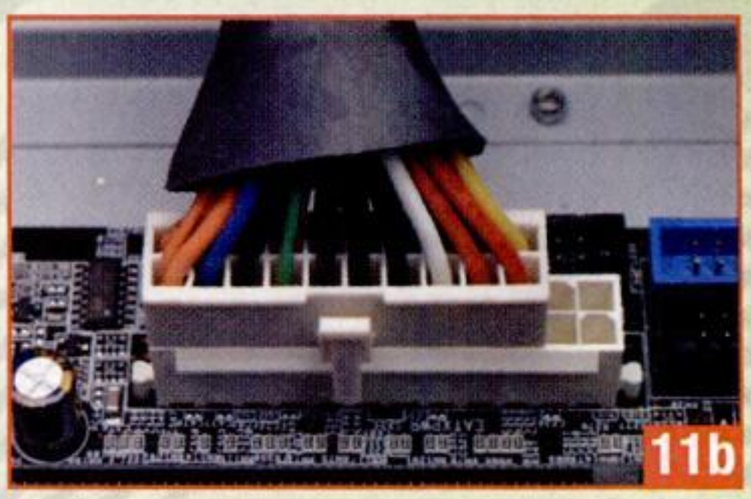


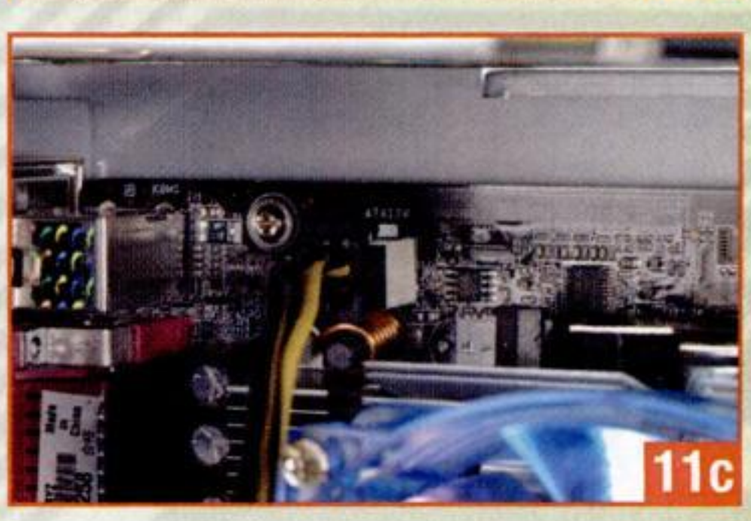
STEP 11: ALPHA TEST: Take your rig for a test ride

Before we install the rest of the hardware, let's take a moment to power up your rig and make sure everything is working properly. Then plug the ATX power connector—it's the big, wide one that comes out of your power supply—into the appropriate socket on your mobo (a). It's keyed, so it goes in only one way. If your PSU has a 20-pin ATX connector you can use it with the 24-pin socket on the mobo (b). Next, connect the ATX 12V connector to your mobo (c). It, too, is keyed, and goes in only one way.

Once your power connectors are plugged in, connect your keyboard, monitor, and power to the machine. Now fire it up. You should see the power-on self-test (POST) screen. If you don't, don't get nervous! Even *Maximum PC* editors occasionally build machines that won't boot on the first try. If yours doesn't, turn to page 61 for some basic troubleshooting tips that should get you back on track. If it does boot, pat yourself on the back and move on to step 12.







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STEP 12: Prep your hard drives

Before you can mount your hard drives in your system, you need to prep the drives. First, consult your case manual and mount whatever kind of rails or other gizmos necessary to install your hard drives in your case. Once that's done, you need to configure your drives for your rig.

There are two basic interface technologies used for hard drives today: parallel ATA and Serial ATA. You're probably familiar with parallel ATA, which uses the wide, old-fashioned, 80-pin ribbon cables, but you may not have encountered Serial ATA drives yet. You can connect two devices to a single parallel ATA port, but connect only one to a Serial ATA port. We're going to explain how to configure both.

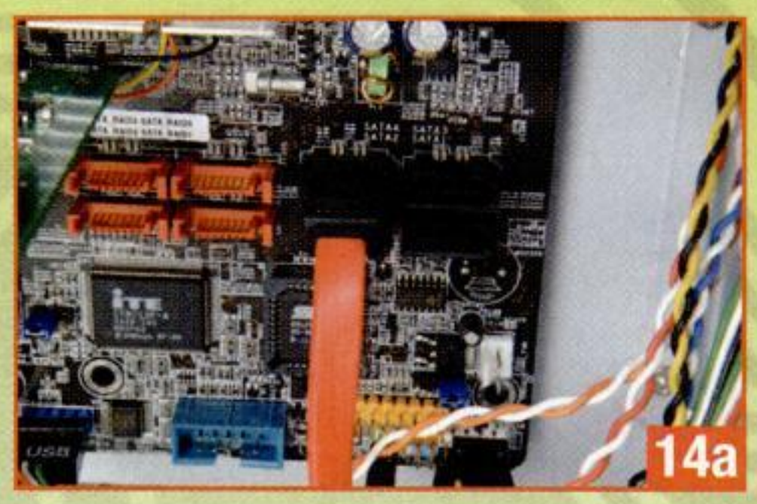
STEP 13: Storage devices

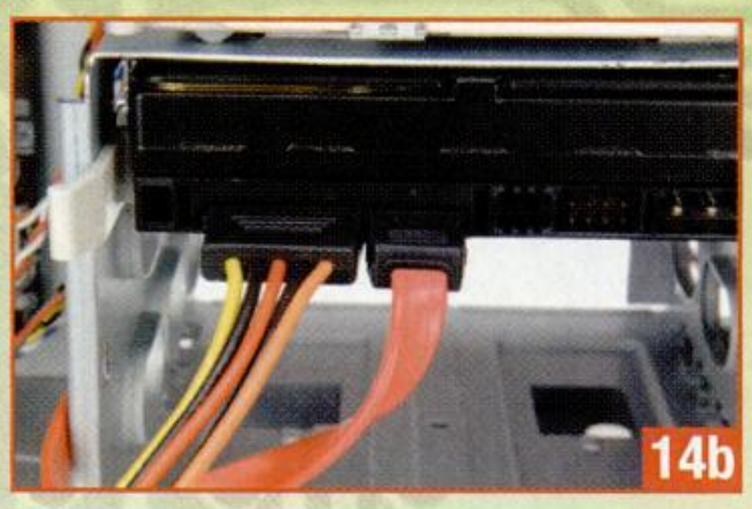
Writable optical drives and hard drives are installed using the old IDE interface or the new SATA interface. The IDE interface requires jumpers to be set. You can have two devices per chain, so set one to master and the other to slave. (If you look on the hard drive, you'll find a guide for setting the jumpers.) Just slide the little plastic jumper over the corresponding two pins to set it to master, slave, or cable select. Cable select sets the last port on the cable to master and makes the middle port slave.

Most optical drives still use IDE ribbon cables to connect to your PC. However, SATA hard drives have pretty much phased out IDE drives, which is great news. Why? For SATA devices, there is none of that jumper malarkey—just plug them into a SATA port on your mobo and you're good to go. The interface is a point-to-point connection, so there's no bandwidth sharing between devices. Installing multiple SATA hard drives is a much simpler process than installing multiple IDE drives.

STEP 14: Connect your hard drives

Next, you need to feed data connections and power to your hard drives. If you're using Serial ATA drives, this is simple: Just plug each drive into one of your motherboard's Serial ATA ports (a). We recommend using the ports built into your mobo's chipset for the drive that will contain Windows—you can find out which ports on the motherboard correspond to that Serial ATA controller by consulting your manual. Be very careful connecting your Serial ATA cables: The connectors are easily broken,





so make sure you don't put pressure on the motherboard or hard-drive connectors (b). Also, some Serial ATA drives offer both a Serial ATA and old-fashioned four-pin Molex power connector—DO NOT USE BOTH POWER CONNECTORS! Use one or the other—it doesn't matter which. (Note: There are two sets of SATA ports on the mobo: standard and RAID. For this project we're using the standard ports.)

Connecting parallel ATA drives is equally simple. With the old-style parallel ATA ribbon cable, you need to make sure all of your drives are within 18 inches of the motherboard's ports, and you need to be very careful not to bend any of the pins on either the mobo or the hard drive. Line up the cable with the port, and using even pressure, push the cable into the port. If you are going to install Windows on a parallel drive, we definitely recommend using the native parallel ATA ports. If you use a RAID controller or ports that use non-standard drivers, you'll have to endure the hassle of installing mass storage controller drivers every time you reinstall Windows.

Caution!

Do not use both power connectors on your Serial ATA hard drives!

STEP 15: Prep optical drives

Now it's time to get your optical drive (or drives) ready for your case. If your case uses any kind of drive rails, you need to attach them now. Attaching drive rails can be tricky: If you don't place them properly, your drive's front bezel won't be aligned with the front of the case. The only way to make adjustments is through trial and error. You'll have to mount the rails on the drive, slide it into the case, and give it the ol' eyeball. It may take a try or two to get the drive perfectly aligned.

Next, you need to make sure that your optical drives are configured with the proper master/slave settings. Most optical drives have labels on the top (a) that will show you the proper configuration for your jumpers. (Backtrack to step 13 if you need a reminder of how to configure jumper settings [b].)

STEP 16: Mount the optical drives

Once again, it's time to mount drives in your case, but this time, they're optical. Before you can slide your DVD and/or CD drives into your case, remove the front slot covers from your case bezel. You shouldn't have to apply strong force to get them loose. If you're having difficulty, check your case manual.

Continued on page 52

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STEP 17: Connect the optical drives

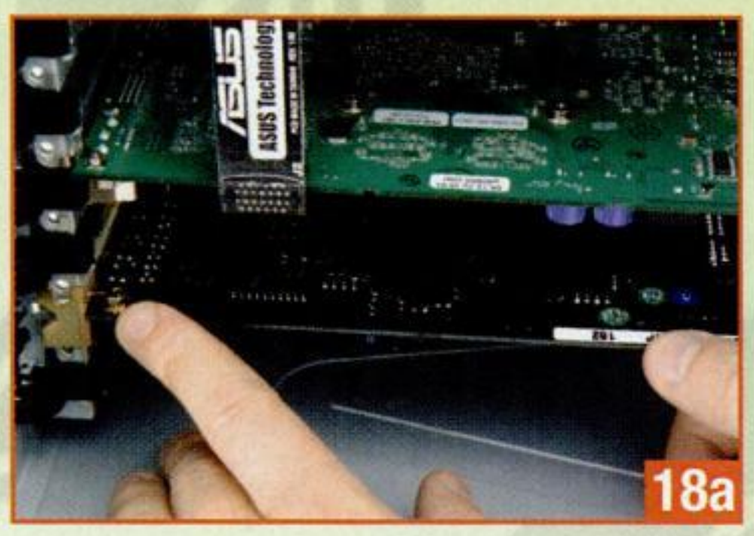
Just like hard drives, optical drives need to be connected to a mobo and a power source to work. Although we've heard rumors of the existence of Serial ATA optical drives, we have yet to actually see any, and we don't expect to before the end of this year. So for the time being, it's strictly parallel ATA cables for the optical drives.

The connections for your optical drives are exactly like those for parallel ATA hard drives, so attach the cables in the same way—line up the cable and apply even pressure to both sides of the connector. You'll also need to run a four-pin Molex power connector from the power supply to each of your optical drives. *Maximum PC* Lab technicians generally no longer bother with the analog CD audio connector or the SPDIF on their optical drives: They're not necessary now that all drives can digitally extract CD audio.

17

STEP 18: Install the rest of your cards

We're almost there. Soundcards, network cards, TV tuner cards, and any other type of card you might want to install should be plugged into your rig now. Installing PCI cards is easy. First, remove the slot cover from your case for the PCI slot you want to use. It doesn't really matter which PCI slots you use for your devices. Next, line the card up with the slot **(a)**. Once you push it into place, lock it down using screws or your case's latches **(b)**.



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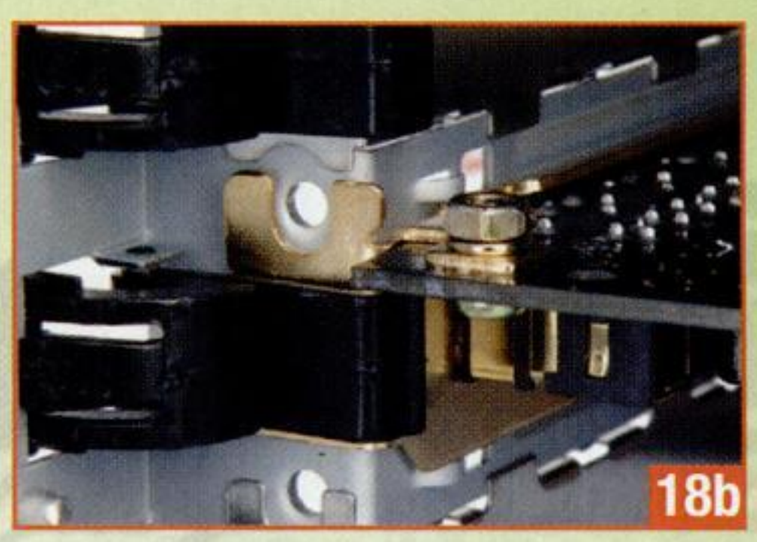

18b

The Secret Life of PCI Express

Why much faster data rates make PCI Express a must-have technology

The PC world is going serial. First it was Serial ATA and now it's PCI Express. That's because it's far easier to ratchet up bus speeds when a signal is sent over a few wires rather than the dozens of wires used in parallel connections. The PCI Express graphics slot will initially be able to transfer 4GB of data in both directions. (Compare that to the 8x AGP slot, which can reach just 2.1GB/s in one direction.)

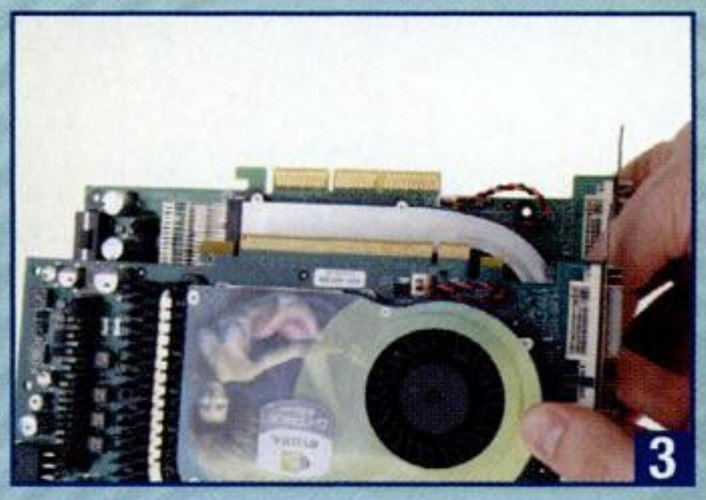
For all the rest of your add-in cards, the tiny x1 (pronounced "bi-1") connector almost doubles the bandwidth of PCI from 133MB/s to 250MB/s. To add more bandwidth, chipset and board designers simply increase the number of "lanes" to each connection. Eventually, motherboards will have x4 slots for add-in cards that will support up to 1GB/s of traffic.

1

Inserting a PCI Express graphics card is really no different than installing an AGP card.

2

Almost all PCI Express mobos use the new ATX 2.0 power spec (white). PCI Express graphics cards use a new 6-pin power connector (black) as well.


3

A PCI Express card (bottom) has a single row of connectors, while an AGP card (top) has two rows of connectors.

Continued on page 55→

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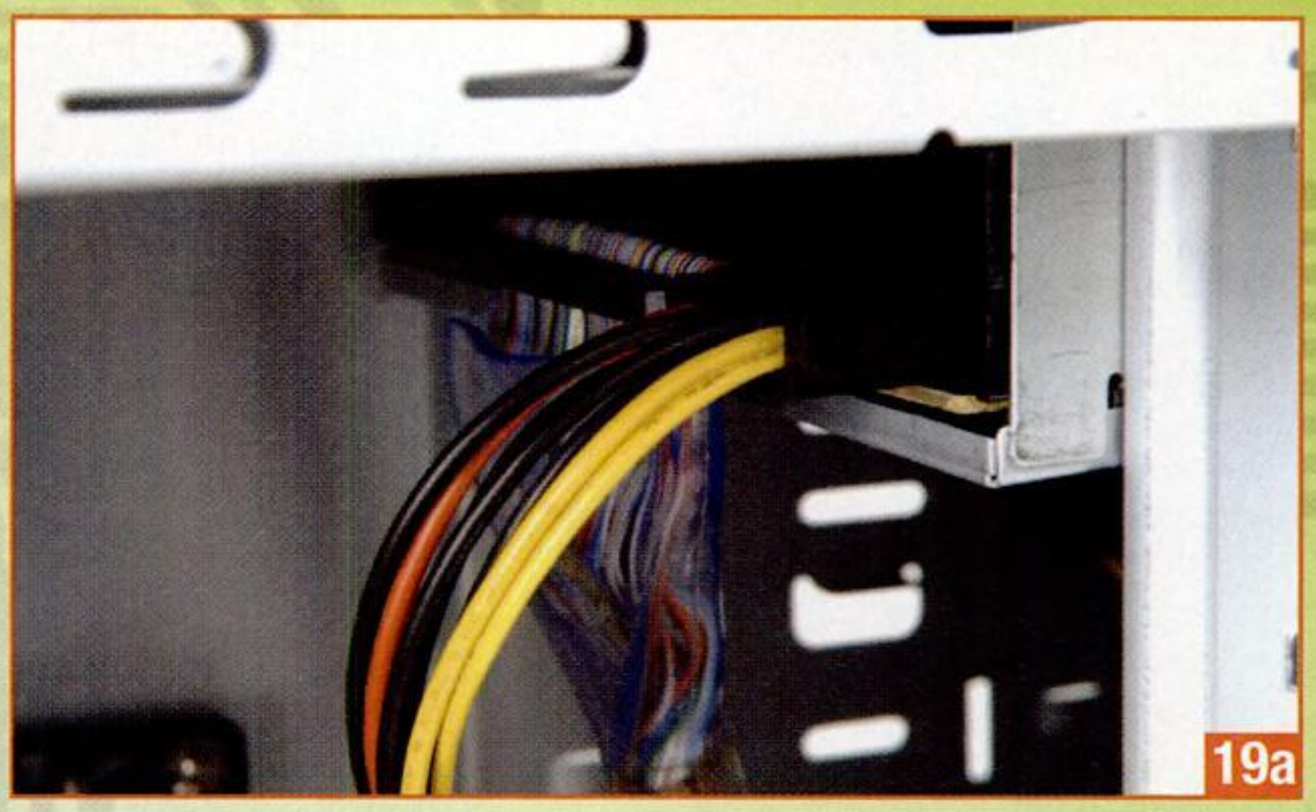
Continued from page 52

STEP 19: Last-minute housecleaning

It's exciting when you've installed the last piece of hardware, but you're not totally done with construction until you've done a thorough double-check. You need to ensure that each component that requires power is connected to the power supply (a), that all your fans have power, and that your cables are tidy (b)—tucking them out of sight will not only make the interior of your machine more attractive, it will also improve airflow and thus cooling in your case! Do this right now, and you'll make life a lot easier on yourself.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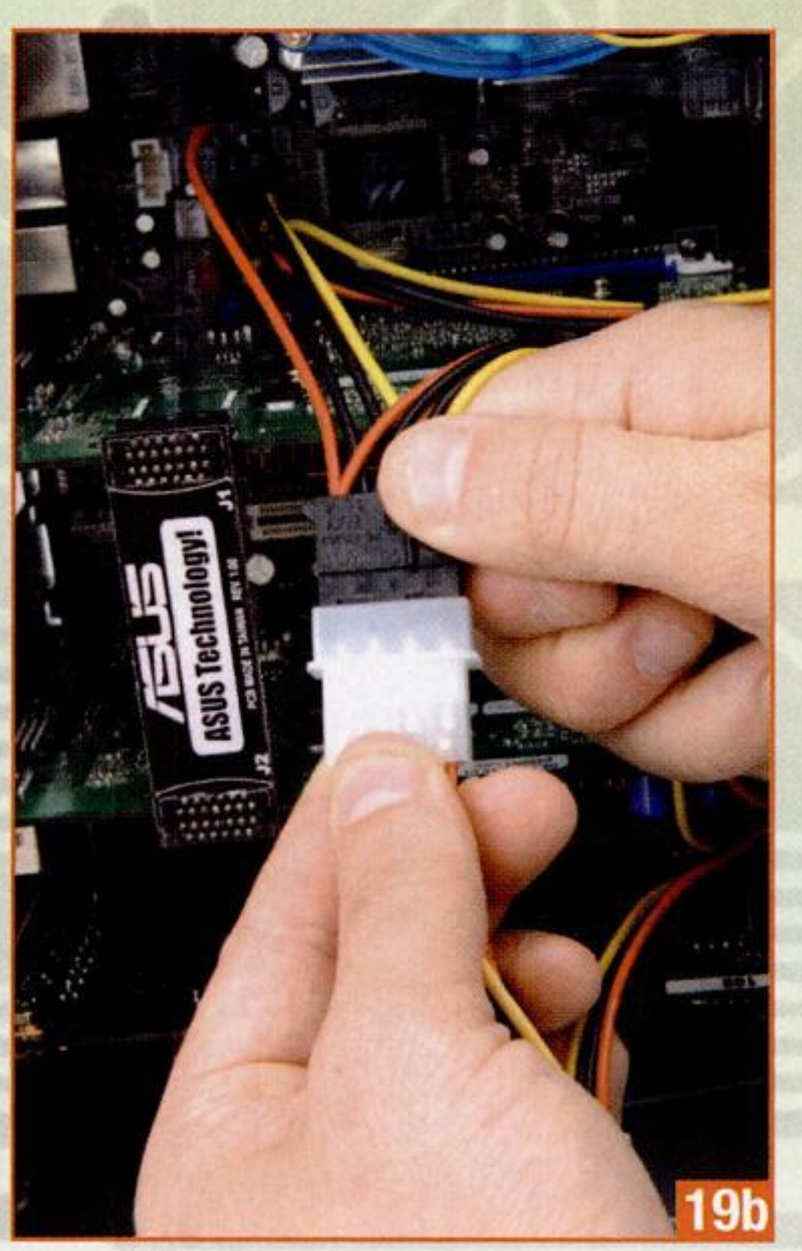

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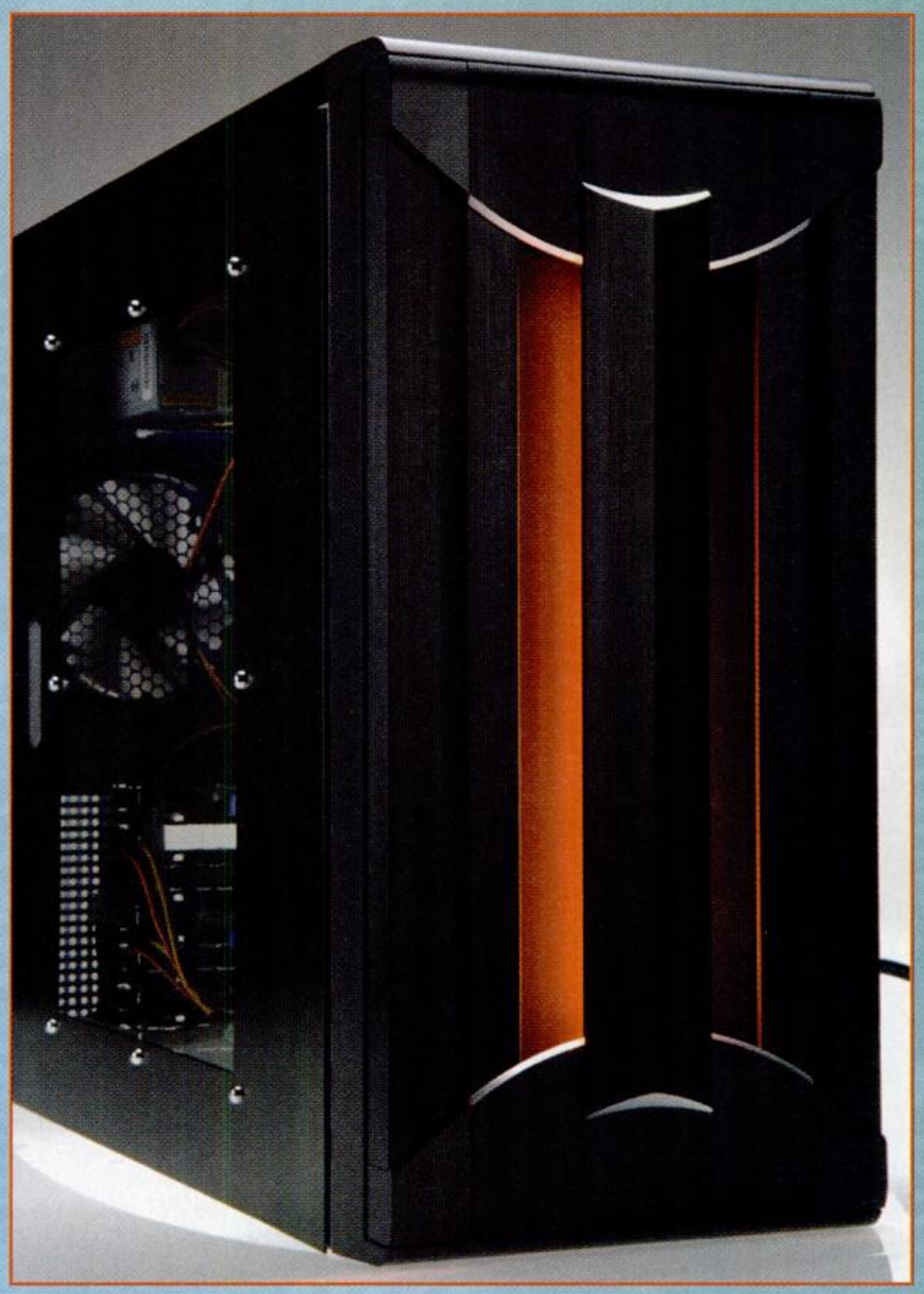
19c

Before you can truly pin a *Maximum PC* "PC Builder" badge on your chest (no, we're not actually going to give you one—you'll have to use your imagination, sorry), there's a little bit of work left. You can put away the screwdriver: Now we need to configure the BIOS—a process that sounds much scarier than it actually is—to get all your hardware running at peak efficiency. And then there's a little thing called the operating system left to install, which has become a fairly straightforward procedure with Win XP. You're on the home stretch: Let's finish the job!

Continued on page 56→

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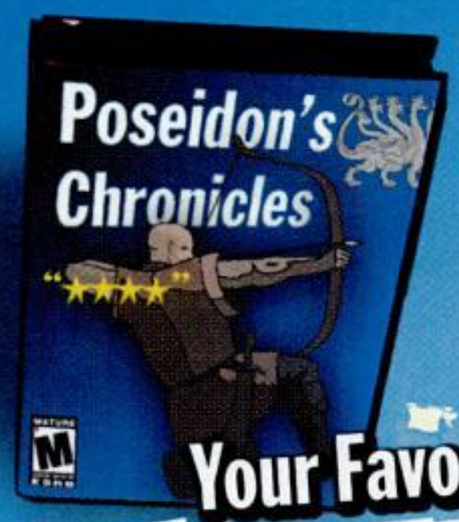

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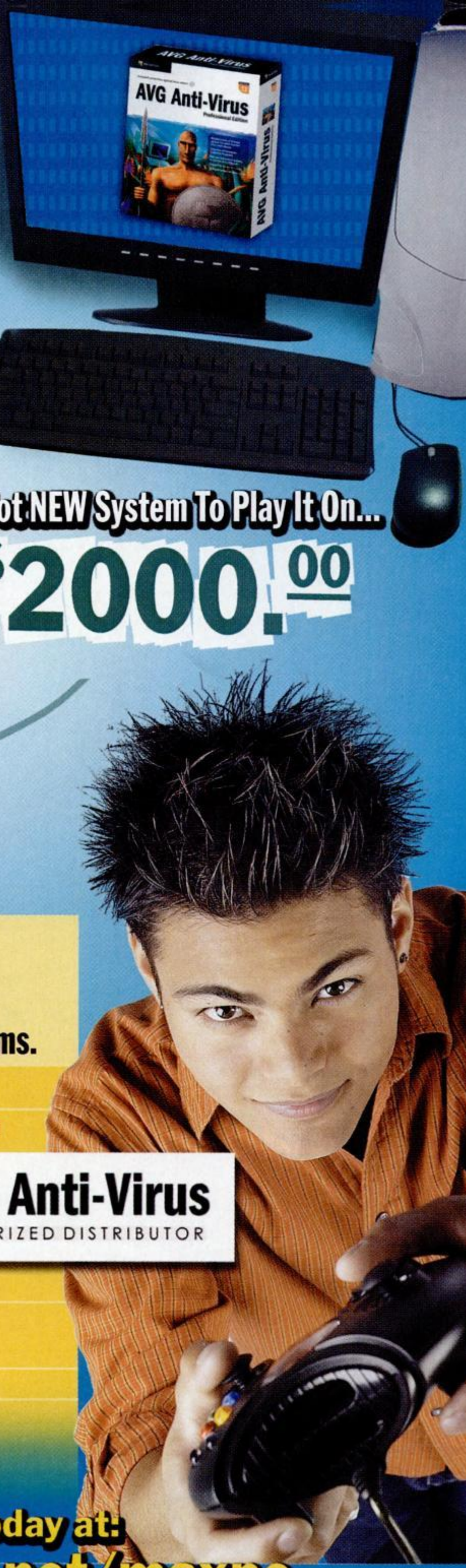

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Continued from page 56

STEP 21: Install Windows XP

To install Windows, all you need to do is pop the CD-ROM into the drive, then press the "any" key when you see a screen prompting you to "Press any key to boot from CD."

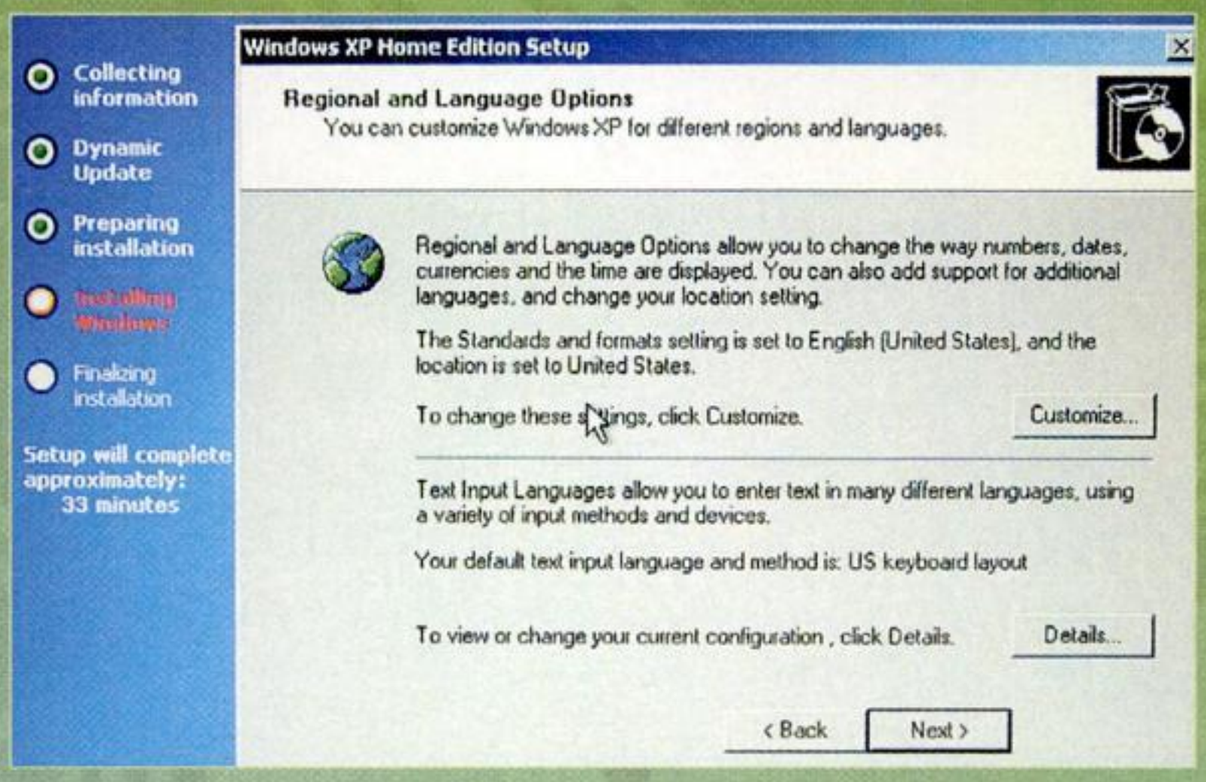
After your system has booted off the CD, the installer will start the text-mode part of the setup. If you want to install Windows on a SCSI drive or RAID array for which XP doesn't include drivers, you'll need to press F6 and install the drivers as soon as you see the blue screen. Otherwise, wait for the Welcome screen.

Follow the prompts until you get to the partitioning screen. Assuming you're using a new hard drive, you'll need to tell Windows how you want to configure your disk. For maximum performance with XP, we recommend creating one big partition that spans the entire drive. We recommend that you use the NTFS format for your new drive. Remember to always do a thorough format on a brand-new hard drive!

Your PC should now be into the GUI stage of the install. The first screen you'll see is the language-options screen. Unless you have a nonstandard keyboard layout or you don't live in the U.S., continue to the next step.

The last major step you have to wade through is the setup of your network. Typical settings work for most cable modems and DSL connections, although you'll need to use manual settings if you have a statically assigned IP address or use some sort of wonky PPPoE connection. After the network is configured, Windows should reboot one last time.

Following the final reboot, you'll be prompted to activate Windows. We recommend that you hold off until you have all the drivers set up for your hardware and everything is working properly.


Collecting information
Dynamic Update
Preparing installation
Installing Windows
Finalizing installation
Setup will complete approximately:
33 minutes
Windows XP Home Edition Setup
Regional and Language Options
You can customize Windows XP for different regions and languages.
Regional and Language Options allow you to change the way numbers, dates, currencies and the time are displayed. You can also add support for additional languages, and change your location setting.
The Standards and formats setting is set to English (United States), and the location is set to United States.
To change these settings, click Customize.
Customize...
Text Input Languages allow you to enter text in many different languages, using a variety of input methods and devices.
Your default text input language and method is: US keyboard layout
To view or change your current configuration, click Details.
Details...
< Back
Next >

Chances are, you'll need to go online to fetch all the latest updates, drivers, and patches for your system. Before you connect to the Internet, make sure you enable the built-in firewall. You can disable it after you've patched the OS, but it will protect your rig until you install the critical updates. To enable the firewall, go to the Control Panel, click Network and Internet Connections, then click Network Connections. Right-click on your connection and click Properties. Go to the Advanced tab and click "Protect my computer and network by limiting or preventing access to the computer from the Internet." Now you can connect to the net a little more safely!

Next, install Service Pack 2. Open *Internet Explorer* and go to **www.windowsupdate.com.** Click the Scan for Updates button and go directly to the Critical Updates and Service Packs section. Install Service Pack 2, and reboot your computer when prompted.

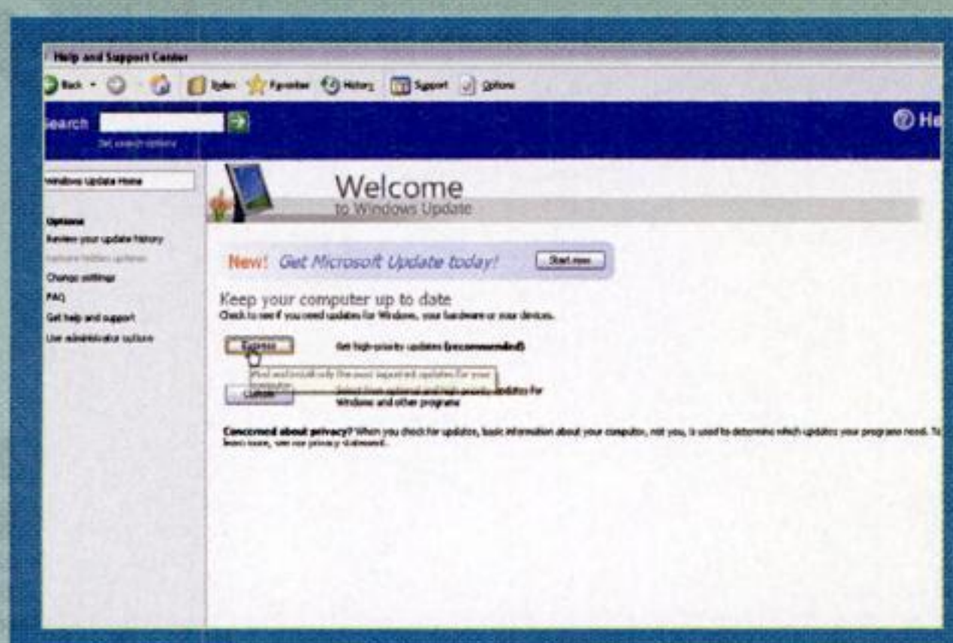
Once the Service Pack is installed, you should install your motherboard's chipset drivers. You should be able to download them from your motherboard manufacturer's web site. They're sometimes called 4-in-1 drivers or the chipset software, depending on the manufacturer. Make sure you reboot when you're done.

Now, go back to **www.windowsupdate.com** and install the latest version of DirectX.

We're almost done. Go to your videocard chipset manufacturer's web site and download the latest version of your videocard's drivers. Once you install them, you'll probably have to reboot.

Install drivers for your soundcard and any other hardware you might have. It's always best to download updated drivers from the manufacturer's web site, but if new drivers aren't being offered, you can always use the drivers off the CD that came with the hardware.

After all your drivers are installed, go back to **www.windowsupdate.com** once again and install all the updates in the Critical Updates section. After the final reboot, you're ready to start using your machine! Did you hear that? You're ready to start using your machine!



Once Win XP is up and running, run—don't walk—to *www.windowsupdate.com* for all the latest fixes.

GET YOUR DRIVERS HERE!

Without the latest drivers, your machine won't run at its best. Get your chipset and videocard drivers directly from the manufacturers before you build.

CHIPSETS	VIDEOCARD
Via: www.viaarena.com	nVidia: www.nvidia.com
Intel: support.intel.com	ATI: www.ati.com
nVidia: www.nvidia.com	
SiS: www.sis.com	

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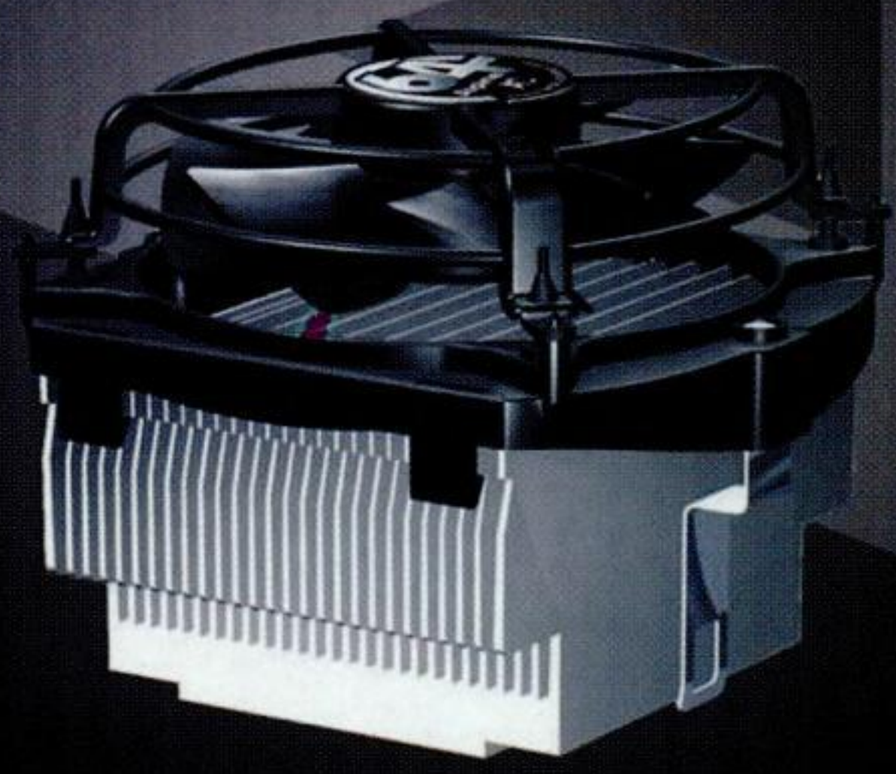

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What to Do if It Doesn't Work

Even *Maximum PC* editors occasionally have problems with their newly built PCs. Here are the three most common PC-building problems, and the *Maximum PC*–approved tips for troubleshooting!

Q I turned on my PC for the first time, and nothing happened. The monitor didn't turn on and there were no tell-tale beeps. The power light is on, but no one's home!

A A completely nonresponsive PC could be the result of any number of problems. First, ensure that your case speaker is plugged into the speaker header on the mobo. (If your machine is having trouble booting, it will beep to let you know the nature of the problem.) If your machine has both onboard video and a videocard, this could cause a conflict. Try swapping the monitor to the other VGA output, at least long enough to disable the onboard video.

If you're still having trouble booting, you might have a more serious hardware problem. There's a good chance your CPU isn't properly seated. You need to remove it from the socket, clean it off with 99-percent isopropyl rubbing alcohol and a paper towel, and then reseat it, and reinstall the heatsink. Be careful when you pull the heatsink off of the CPU: You may need to twist the heatsink slightly to get it to release from the CPU without forcibly yanking the CPU from its socket.

The last thing to check for is a misplaced motherboard standoff. If you have an extra mobo standoff screwed into your tray, it can short out crucial components of your mobo and render your system unbootable. Unfortunately, the only way to check for extra standoffs is to completely remove the mobo from the case.

Q I'm having trouble getting the Windows installation started. Why won't it start?

A Most likely, Windows is having trouble detecting your hard drive. The first thing you should do is check your cables. Make sure your cables are firmly connected at both the drive and the motherboard end, and that your power cable is plugged into the drive. If your cables are in good order, you should ensure that your hard drive is plugged into the proper port. Unless you're installing Windows on a RAID array, you should connect your drive to the ports connected to your chipset's native controller. You should also ensure that the proper ports are enabled in your BIOS and are set to the correct mode. Some motherboards allow you to use Serial ATA ports for either standard drives or a RAID array: You'll need to consult your documentation for the specifics. If for some reason Windows still doesn't see your hard drive, you may need to install drivers for your controller. To install these drivers, you need to temporarily connect a floppy drive to your computer. Connect the floppy, then boot your computer and start the Windows installer. Press F6 when prompted to install your driver. Put the driver floppy that came with the motherboard in the floppy drive and follow the onscreen prompts.

Q I powered up my machine and it's making all sorts of beeping noises! What do they mean?

A Beeping noises generally mean there's a problem with a crucial piece of hardware. They can mean that your memory isn't properly inserted, that there's a problem with your videocard, or even that your keyboard isn't properly plugged in. Error codes vary from mobo to mobo; consult your motherboard manual to decode the specific beep code you're hearing. ■

The 7 Dos and Don'ts of PC Building

DON'T Close the PC case before your first boot! Doing so will invoke Murphy's Law, guaranteeing that something will go wrong and you'll just have to open up the case again.

DO Make sure you have an adequate power supply for your hardware. A 350W power supply is the bare minimum today. You need 450W or higher for a fully loaded gaming rig.

DON'T Work inside the PC while the power is on.

DO Check your case fans often for gunk buildup. A fan can't do its job if it's clogged with cat hair!

DO Screw in your hard drives and optical drives on both sides. It helps stabilize the drives and reduce noise.

DO Write down the model numbers and serial numbers of all your internal hardware in case you need to download documentation or call technical support later when the PC case is closed.

DON'T Position your hard drives too close together! If you're using more than two drives, allow some room for airflow between them. Heat kills!

Continued on page 63→

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Putting Our Penny-Pincher to the Test

All that cost savings wouldn't mean squat without the benchmark numbers to back it up

We performed some preliminary benchmarks during our videocard/CPU selection, so we had a pretty good idea where this rig would stand before we subjected it to our full battery of tests. Regardless, we're still impressed with our baby box. It handled everything we threw at it with aplomb, and ran *Quake 4* at 52fps with 4x antialiasing and all options set to High.

The only rub to speak of is the resolution issue. We ran the tests at a midrange resolution of 1280x1024, which is still a fairly common resolution these days. Heck, most 19-inch flat panels max out at 1280x1024! It wasn't a huge surprise, but gaming performance slowed to a crawl when we cranked antialiasing beyond 8x. Though the 7600 GT is very capable at modest settings, its slim 128-bit memory bus can't handle the bandwidth demands of high AA settings (more expensive cards have a wider, 256-bit memory bus).

Naturally, with an SLI-capable motherboard, one of the very first upgrades we'd make to this rig would be to slot in another 7600 GT for hot, sweaty dual-card action. In fact, we've done just that, running two 7600 GTs in SLI for kicks. Interestingly, when we first ran the SLI benchmarks, we had AA and anisotropic filtering turned off, and the benchmark numbers were exactly the same as if we had one card. In essence, what the second card brings to the table is the ability to crank up antialiasing and texture filtering, giving you vastly improved image quality.

BENCHMARKS

	SINGLE VIDEOCARD	DUAL VIDEOCARDS
DOOM 3 (FPS)	35.3	56.9
F.E.A.R. (FPS)	52	83
QUAKE 4 (FPS)	44.8	70.8
3DMARK06	3,026	4,926
3DMARK05	5,958	10,158

Real game tests were run at 1280x1024 with all settings on High and antialiasing set to 4x. 3DMark05 and 06 were run at the default setting needed to obtain an official score.

And the Rest of the Parts...

For the purposes of our budget, we focused solely on building a self-contained rig, assuming you'd use your current monitor, keyboard, mouse, and speakers with your new $1,000 rig. If you want to spec a full system, here are a few budget components that deliver great performance at a reasonable price.

LCD Monitor: Dell 1907FP

If there's another brand-new 19-inch LCD that offers all the amenities of Dell's 1907FP and costs as little, we certainly haven't seen it. The stylish, slim package sports the full range of ergonomic adjustments—height, tilt, rotate, swivel; includes four powered USB 2.0 ports; and, most important, provides solid screen performance. Folks, it's an absolute steal.

$340, www.dell.com

Speakers: Logitech Z-5300

When it comes to gaming speakers, you don't want bang for the buck, you want *boom* for the buck. And Logitech's Z-5300 can't be beat on that score: This THX-certified, 5.1-channel system cranks out 280 watts of power for a street price well below $150.

$135, www.logitech.com

Keyboard: Generic

In our minds, there are "old" keyboards that don't have bells and whistles but work wonderfully. And there are "new" keyboards that cost twice as much and are littered with useless features like F-Lock keys, volume dials, and "shopping" buttons. Screw *that*. We'll take an old-school QWERTY board over that new junk any day. **$15**

Mouse: Logitech G5

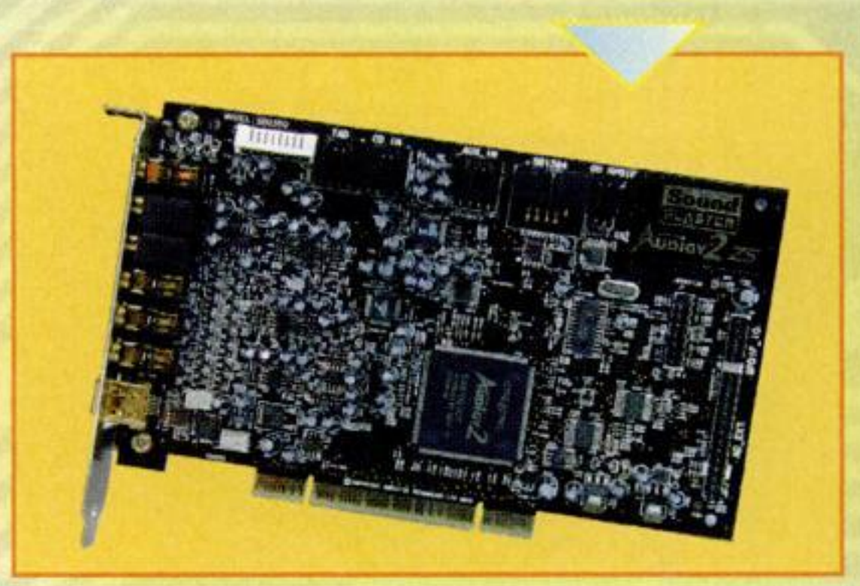
The G5 is a mouse fit for a king—but at $50, any wage-slave can afford it. We love its adjustable-weight feature, its smooth-as-a-baby's-hiney laser tracking, and its customizable precision. If you're on a *really* tight budget, we recommend Logitech's MX 518 mouse, which is just $35.

$50, www.logitech.com

Soundcard: Creative Labs Audigy 2 ZS

Our $1K PC uses onboard audio of the Realtek persuasion. It gets the job done, but doesn't produce what we'd call good, or even great, audio. For just $75, we can upgrade to the last-gen Audigy 2 ZS. This formerly high-end 7.1 card sounds fantastic, and it's much cheaper than the costly X-Fi boards.

$75, www.creativelabs.com MPC



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BUILD YOUR OWN

The only way to get the exact notebook you're looking for—with a CPU, hard drive, and chassis that perfectly suit your needs—is to build your own. Let's get started!

You can build a desktop PC while chained in an underwater cage filled with testy sea bass. You can build, boot, and overclock a small formfactor rig blindfolded. You think you're the Jedi Master of do-it-yourself PC building. Think again, Padawan. Are you ready for the next step? Are you ready to build your own notebook?

Whether you call it a DIY notebook, whitebook, or barebook, configuring and building your own laptop computer is the final test before you ascend to PC greatness. Of course, it goes without saying that building your own notebook is significantly more challenging than building a mere desktop or SFF.

With their cramped interiors and butterfly-delicate components, notebooks aren't a wise undertaking for the ham-fisted tyro who has problems snapping a memory module in place without bending things. That doesn't mean you should be afraid. If you have the motor coordination and patience to build a model X-wing, you can easily build your own notebook.

So when you're sitting in a café cruising the net and someone asks you who built your notebook, you can respond with pride: "I did!"

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BUILD YOUR OWN: WHAT YOU NEED TO KNOW

We know you have some questions, we had a ton before we got started. We'll tell you why you'd even want to build your own laptop, and let you in on the pros and cons

Q: Does anybody really build their own notebook?

A: We'll admit that building a notebook isn't what the normal, or even advanced, PC user typically does. Look into the computer room of the most hardcore PC master and he or she will probably have a Sony, Dell, or HP notebook mixed in with a handful of home-built towers. But while building your own notebook is still a fringe hobby, it's definitely picking up steam: More and more vendors are selling notebook kits directly to end users.

Q: How is building a notebook different than building a desktop PC?

A: When you build a desktop PC, you can select the case, pick a motherboard and CPU, and so on. Building a notebook is more akin to building a small-formfactor system, where you choose a case and motherboard combo, and then take whatever other hardware will work it. With a notebook, you first need to select the chassis you want, which informs the type of CPU you'll use, the type of 3D card you can install, and even the size screen you get. Once you've selected the chassis, all you have left to do is purchase memory, a hard drive, and other accessories.

Q: If I can't change the screen, graphics, or CPU family, do I really have control over any of the configuration?

A: Well, yes. Many of the big companies let you make minor adjustments to the configuration of their notebooks when you place an order, but they usually limit certain components to more expensive models. You can't, for example, order a $500 budget 1.4GHz Celeron M notebook and have the company upgrade the CPU to a 2.2GHz Pentium M. In order to do that, you have to step up one or more classes of notebook, which naturally cost more money. In a DIY notebook you can run whatever processor fits your budget and requirements—from an $80 1.3GHz Celeron M650 to a $600 2.26GHz Pentium M 770. The same goes for the hard drive, optical drive, and everything else.

Q: What tools will I need?

A: To build the exact same notebook we built, you'll need a quality set of precision screwdrivers. We recommend that you invest in Wiha's basic eight-piece set of precision screwdrivers (www.wihatools.com) that includes both slotted and Phillips tools. Don't even think of using the cheap $3.99 "jewelers" screwdriver set you picked up at the flea market: These cheap tools usually result in bunged-up or stripped screws. We also needed a paper clip to transplant our optical drive, and a magnet to pick up the screws we dropped. You should keep a container handy for storing the screws, as well.

Q: What are the potential pitfalls?

A: The biggest hurdle to overcome is accidental destruction of the even-more-delicate-than-normal mobile hardware: It's much easier to bend, break, or destroy the notebook during construction than it is with standard desktop parts. And beyond that, as with any DIY project, the only person responsible for troubleshooting and fixing problems will be you. (While our AOpen kit comes with a one-year warranty, there's no option for an extended warranty and no on-site tech support.)

Q: What does a DIY notebook cost and where can you buy one?

A: We used an AOpen 1559 unit for our step-by-step walk-through. It came with a combo DVD-ROM/CD-RW drive and cost about $590. We added a 2.13GHz Pentium M 770 ($450), 1GB of DDR2 RAM from Corsair ($140), a 100GB SATA Seagate Momentus 7,200rpm drive ($160), a Mini PCI Wi-Fi A/G/B card ($32), and an 8x DVD burner that supports dual-layer burns ($80). The last two components were difficult to find, but we got ours from Newegg.com. The 1559 can't be purchased directly from AOpen, but it's available from both Chemusa.com and Jetta.com as a barebook.

Continued on page 69→

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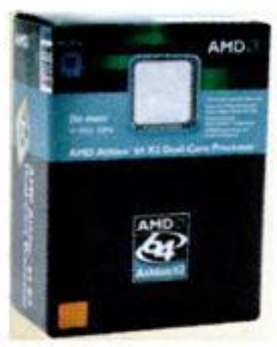

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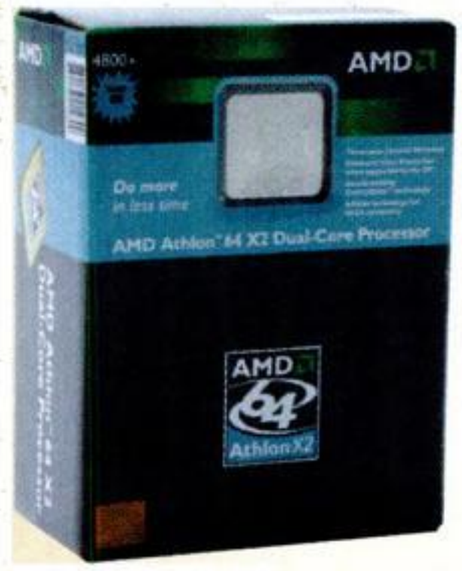

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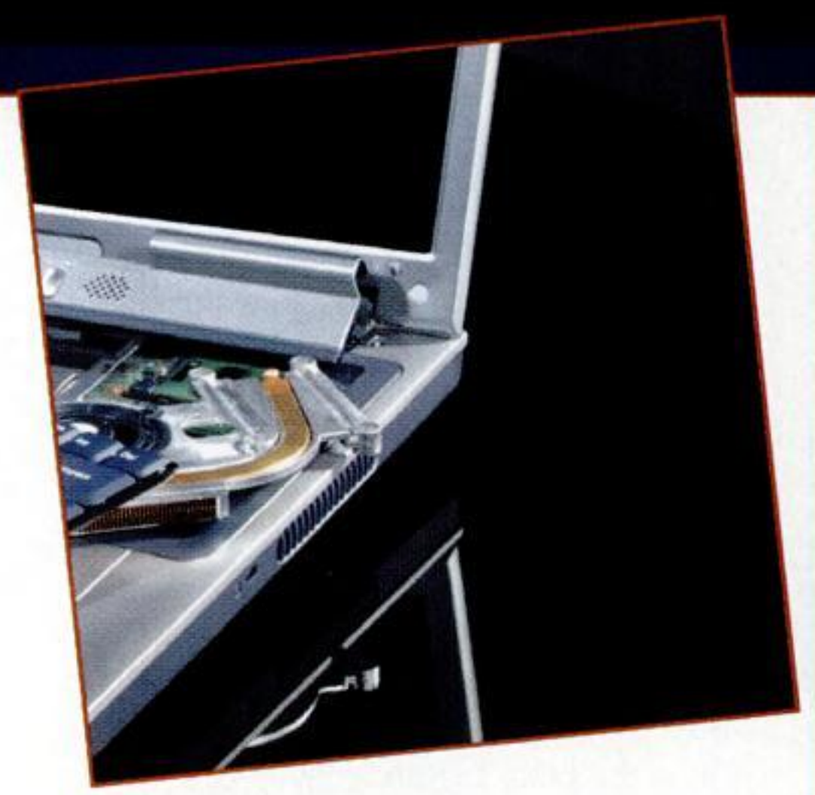
BEFORE YOU BUY

You've decided you're ready to build your own laptop, but it's a little different than building a desktop. Before you purchase the first part, you must read our buyers guide



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Desk Potato or Road Warrior?

Before you search for a DIY platform, you should first figure out what you really want to do with the notebook. Do you want a widescreen, 10-pound desktop-replacement beast with the power of a desktop and piss-poor battery life, or would you prefer a lightweight, long-running notebook PC that has the gaming prowess of a turnip? These might sound like extremes, but that's the decision you face with most bare-bones notebook kits.

The CPU

Generally, desktop-replacement notebooks lean toward Pentium 4 and Athlon 64 CPUs, which can be cooled and powered by the larger chassis designs. That's not always the case, though, as we're seeing more and more large desktop-replacement notebooks with Pentium M chips. Which should you buy? We recommend the Athlon 64 for desktop replacements: it's fast, and its thermals aren't out of control. If you're looking for more portability, the Pentium M is a great CPU that offers plenty of power at high clocks and pretty good power savings when purchased in lower-power-consumption trims. What about the P4? While it's not too horrible at, say, 3GHz, at 3.8GHz and 3.6GHz, it's just too hot to handle. We'd take the Athlon 64, a Turion 64, or a Pentium M over a hot-running, high-clocked Pentium 4.

Far Cry or Yahoo Chess?

As with the CPU, you need to weigh your needs for graphics. Graphics chips soldered on the mobo, such as Intel's alleged "Extreme" integrated GPU, are as genuinely extreme as a Mountain Dew ad. If you want the best battery life, however, integrated is the way to go. At the other end of the spectrum are discrete mobile solutions, such as nVidia's GeForce Go 7800 GTX. It offers gaming performance that's faster than many desktop machines. It's fast, but it's also power-hungry and hard to cool. Because it's so hard to cool, you'll only find this part in large notebooks. In the middle, you have nVidia's GeForce Go 6600, which offers pretty good gaming performance and middle-of-the-road battery consumption. A good rule of thumb: The faster your 3D card, the more juice it's going to suck.

Upgradeable Graphics

There are currently two standards for PCI Express graphics modules: nVidia's MXM and ATI's AXIOM. Neither is compatible with the other, and it's almost impossible to tell who's winning the standards battle. The upshot is that upgrading your nVidia-based notebook with ATI graphics, or vice-versa, probably won't happen. (And even if you could get your hands on a faster card for your notebook, is the chassis capable of keeping it cool?) You should assume that any graphics-upgrade path will be limited to the vendor you begin with.

Hard Storage

Depending on what notebook you buy, you'll either have the old-school (but still quite capable) parallel interface or the more modern SATA connector. Don't get hung up on this discrepancy, as the interface doesn't really matter. It's the actual speed of the drive that matters most. Your choices range from 4,200rpm (slow) to 5,400rpm (medium) to 7,200rpm (fast). And just like every other component, the faster the spindle speed, the more power it consumes. Once you choose the interface and speed, select a drive with enough capacity for your needs. There's one more catch, though: Some notebook chassis will only accommodate drives of a certain height—so make sure the drive you buy is thin enough to fit into your rig.

Don't Leave Home Without It

A move was made last year to finally replace the ancient PC Card interface with the much faster ExpressCard. ExpressCard hooks into PCI Express and USB and offers about 500MB/s maximum theoretical throughput, versus a CardBus PC Card's 33MB/s. We like more speed, but unfortunately haven't seen many peripherals that need that kind of bandwidth. Even worse, a majority of ExpressCard notebooks do away with PC Card slots altogether, so you won't be able to use your legacy hardware. However, if you have special needs, such as FireWire 800 or Gigabit, ExpressCard is the way to go.

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STEP-BY-STEP: ASSEMBLING YOUR RIG

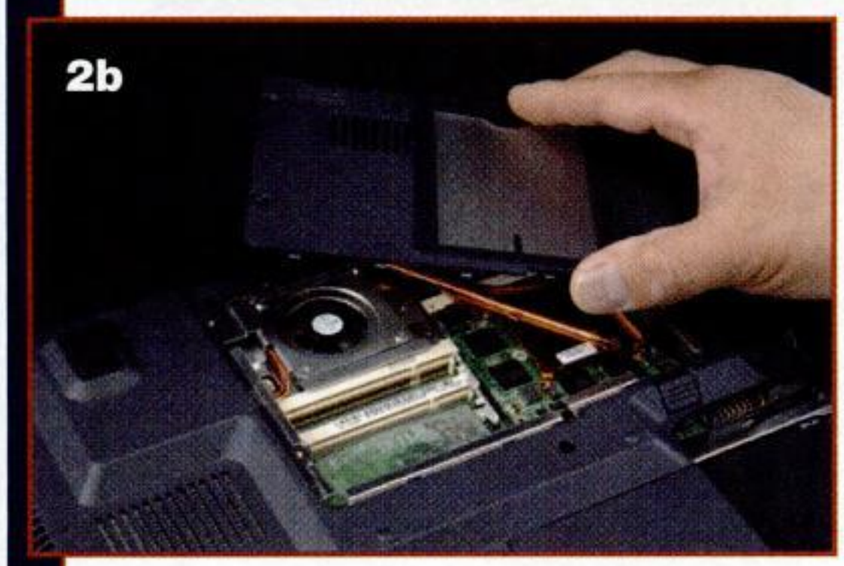
Follow our guide—carefully—and you'll have your new laptop up and running in no time. Before you do anything, make sure you read (and understand) every step

Step 1: Prep for Takeoff

To avoid damaging your components, remove the battery before you begin. Our notebook came with a plastic sheet covering the LCD, to prevent damage during shipping. We recommend that you leave this protective shield in place while you build the notebook.

Step 2: Access RAM and GPU

Flip the notebook so you can access its bottom and unscrew the four screws that hold the large access plate shut (image a). Slide the plate to remove it (image b).



Step 3: Turn Your Screw

Remove two of the screws located at the rear of the notebook's underside, below the access plate. These attach to a panel on the notebook's face that contains the speakers, the power button, and the CD control buttons, and which also prevents the keyboard from moving (see image 5). AOpen calls this the "middle panel."

Step 4: Pry It Off

Flip the notebook upright and open the screen so that it's flush with the tabletop. Using a slotted or flat-head screwdriver, begin carefully prying the middle panel from the notebook starting from the right-hand side. This is one of the only steps where you can easily break something if you're too rough. Also keep in mind that the panel is wired to the motherboard, so don't lift the panel more than an inch while removing it. Once you have the right side of the panel up, you can slowly work your way to the left-hand side.

Step 5: Lift and Tuck

You can unplug the CD player controls, the LCD display, and power, if you must, but for our purposes, you can just lift the entire panel and tuck it out of the way.

Step 6: Don't Tear the Ribbon

You can now lift out the keyboard. Start from the top of the keyboard and slowly tilt the keyboard out. You'll need to apply gentle pressure to get the keyboard clear of the set of plastic tabs along the side of the case. The keyboard is also attached to the rig by a ribbon cable at the bottom, so be gentle. Once it is clear of the chassis, you can flip the keyboard forward to give you full access to the CPU and Mini PCI card. You do not have to remove the ribbon cable from the keyboard.

Step 7: Call Me Centrino

You won't find Mini PCI Wi-Fi cards at most PC stores, so we turned to Newegg.com, where we found an Intel 2915ABG card for a mere $32. Mini PCI cards install like SO-DIMM memory cards, so you'll need to align the card with the slot (image a). Then attach the two antenna leads. The black lead should snap into the antenna connector on the left, while the gray lead goes on the right

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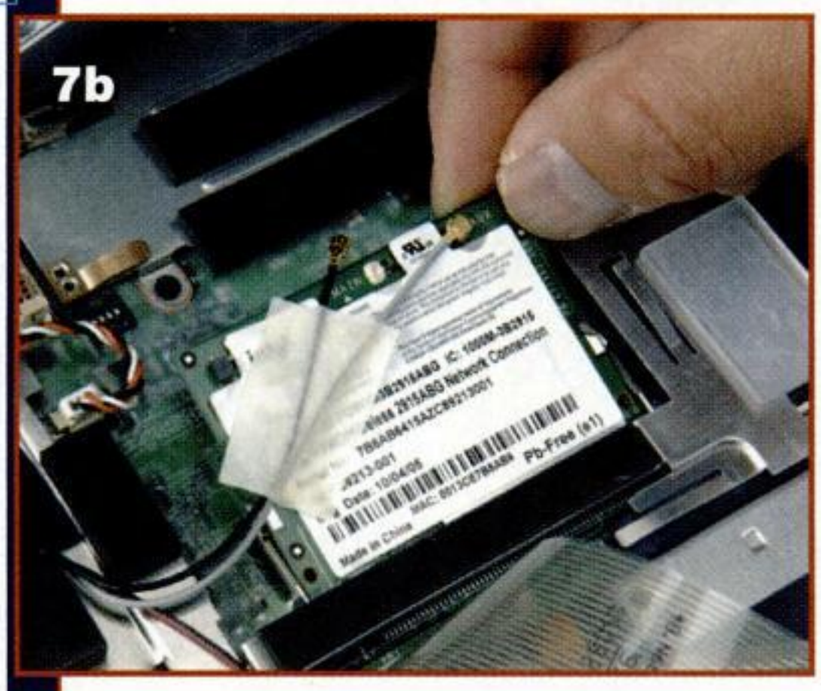
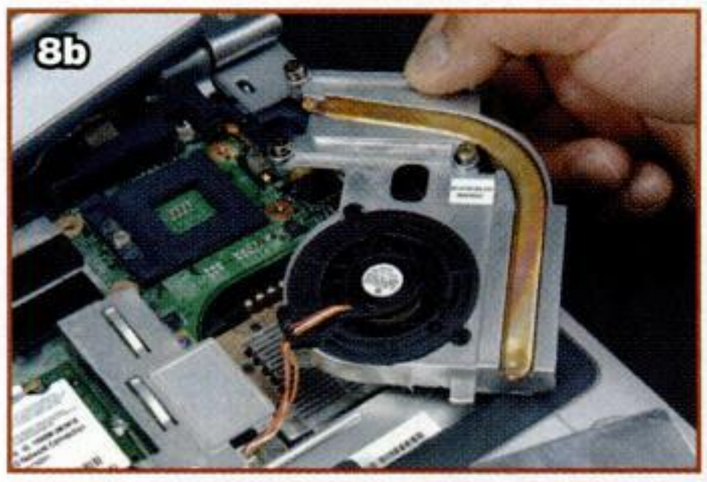
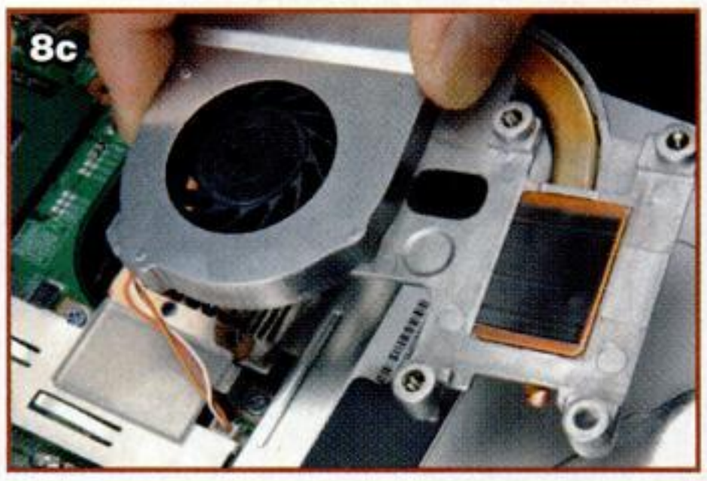
(image b). Lock the card into place by putting it into the Mini PCI slot at an angle. You should be able to push the card in about an eighth of an inch. Once it's in place, tilt the card toward the notebook until the retention arms on either side of the card lock it in place. We now technically have a "Centrino."



Step 8: Remove the Heat Pipe

A heat pipe and fan will cool your CPU. Unscrew the four screws holding the heat pipe down over the socket (image a). You should now be able to slide the heat pipe out of the way (image b). If you want to completely remove the heat pipe, you have to unplug the cooling fan, but that's not necessary. You can simply move the cooling assembly out of the way, and rest it on top of the keyboard (image c). Make sure you don't smudge or dent the thermal pad on the bottom of the heat pipe, though.





Step 9: Install the CPU

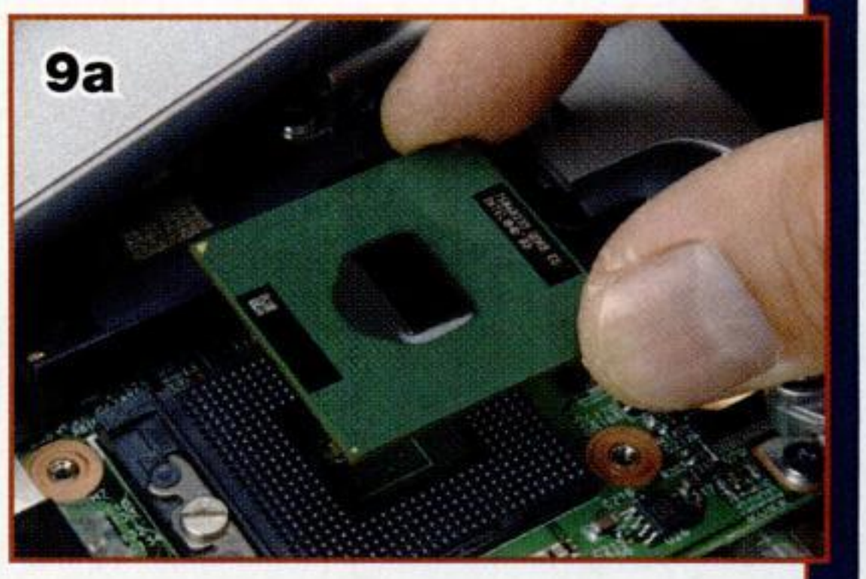
Intel's Pentium M processor can be difficult to find, but online vendors such as Newegg.com carry the proc. The Pentium M 770 we selected (the fastest this notebook's chassis and cooling mechanism are rated for) is clocked at 2.13GHz on a 533MHz front-side bus and has 2MB of L2 cache. Align the CPU's gold arrow with the arrow on the socket (image a). It should drop right into the socket, without requiring any force. If it doesn't, the socket might be in the closed position. Use a slotted screwdriver to unlock the socket and try again. Then use the slotted screwdriver to lock the CPU in place (image b).

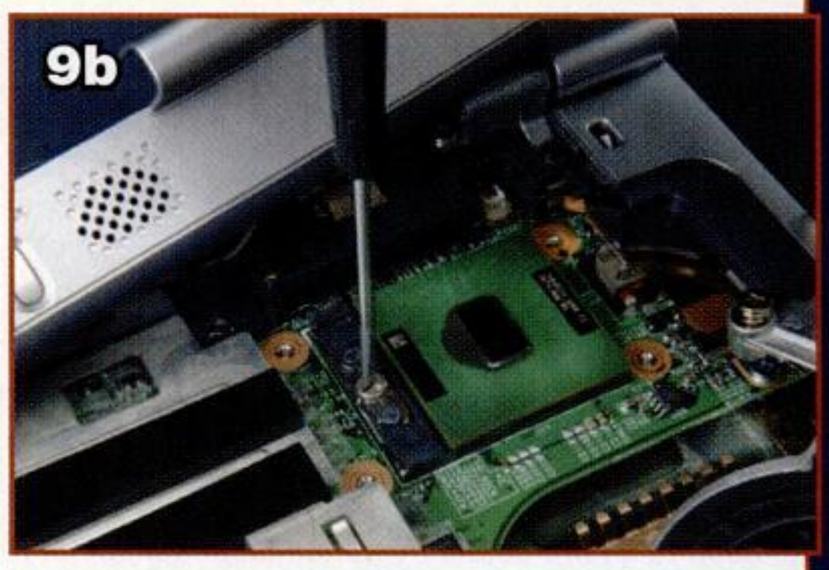
Step 10: Open the Port

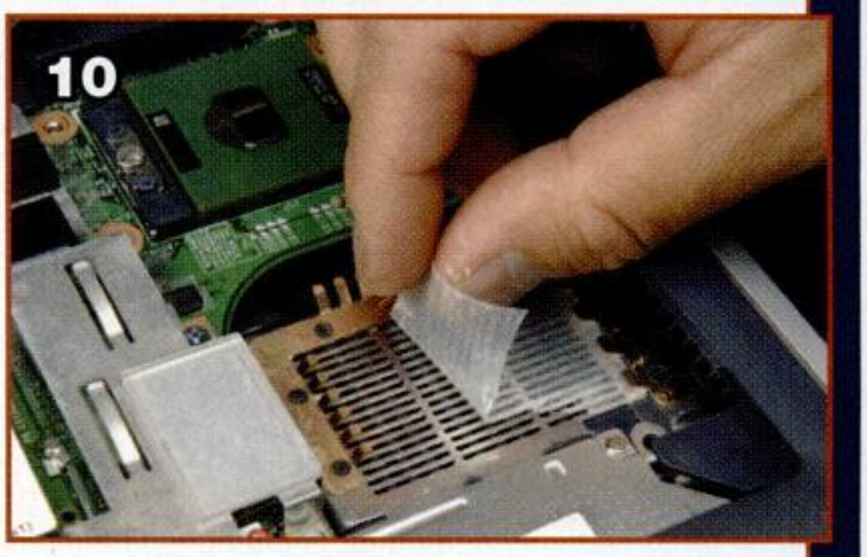
Our bare-bones notebook came with plastic tape blocking the intake port for the CPU heat pipe. Make sure you remove the tape, or the notebook will overheat.

Step 11: Reinstall the Heat Pipe

When you screw down the heat pipe, make sure the screw heads are flush with







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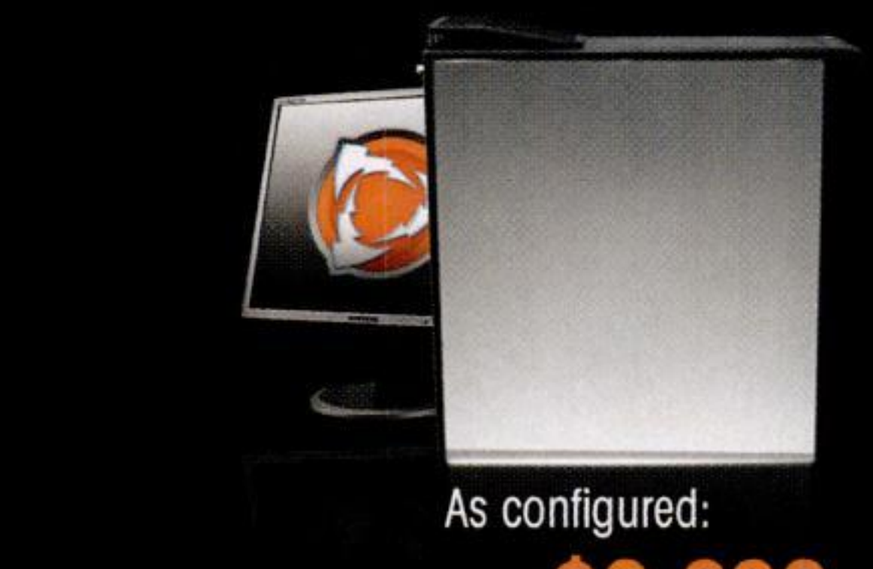

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the heat pipe, or the heads might bump into the back of the keyboard.

Step 12: Remount the Keyboard

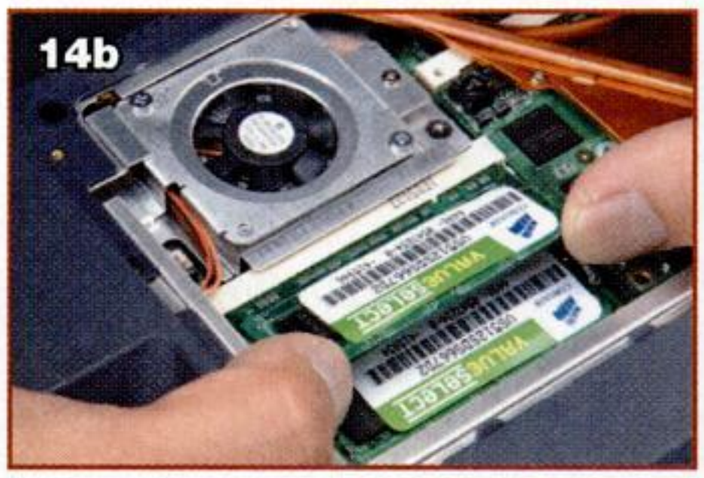
Reinstall the keyboard by hooking it under the lower palm rest. In our picture, it's the little metal tab just under the right cursor key. Gently tilt the keyboard back into place while applying firm but gentle pressure along the sides to push the keyboard past the plastic tabs on the side of the keyboard tray that hold it in place. Make sure the ribbon cable along the bottom of the keyboard is flat and not being pinched. Also make sure the two wires for Wi-Fi are out of the way, so they won't be pinched.

Step 13: The Battle for the Middle Panel

Reinstall the middle panel by snapping it into place from right to left. It should snap right into place. If the keyboard or middle panel shows any bulging, something might not be aligned properly or a wire could be in the way. If that happens, gently remove the middle panel and keyboard and check that everything was properly installed.

Step 14: Install the RAM

The 915-chipset supports dual-channel RAM, which requires you to install a pair of SO-DIMMs. We used a pair of 512MB DDR2 modules. Install the first module in the lower bank by pressing the contact edge of the RAM into the slot about an eighth of an inch, while holding the module at an angle. Slowly, and with even pressure, push until the RAM's seated firmly in the slot, and you can no longer see the gold connectors (14b).



Step 15: Snap the RAM into Place

Once it's firmly in the slot, tilt the module down into place until the two retention arms lock. While you're here, reinstall the two screws from Step 3 that hold the middle panel in place. You should now replace the panel from Step 2 and reinstall all four screws.

Step 16: Open the Hard-Drive Bay

Remove the hard-drive bay cover, which is to the left of the battery compartment (image a). Pull out the hard drive caddy (image b). Because we're building a notebook aimed at midrange power instead of all-out battery performance, we selected a 7,200rpm, 100GB Seagate Momentus SATA hard drive. The Momentus drive we selected features SATA data and power connectors and does away with those delicate little pins used in parallel ATA drives (image c).

Step 17: Mount the Drive

Mount the hard drive to the caddy using the screws provided by the kit. Our kit only came with two screws even though there were four holes. We split the difference and

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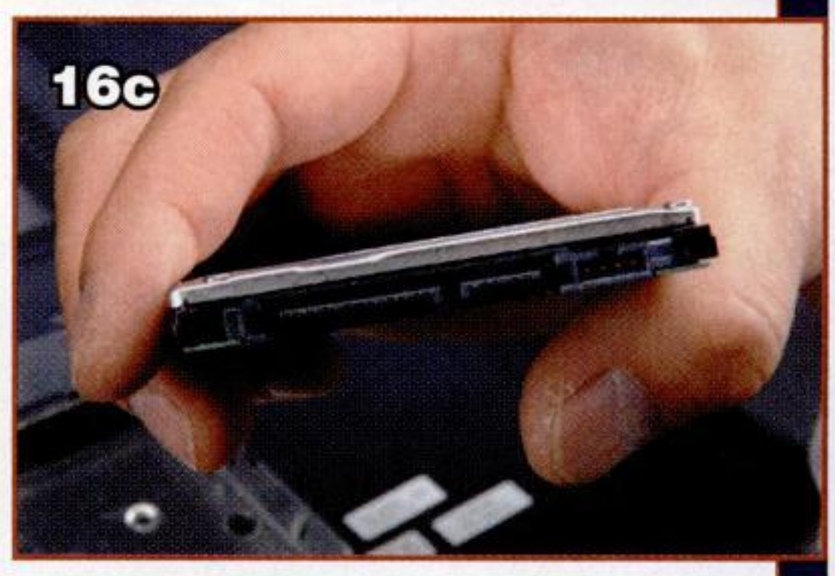

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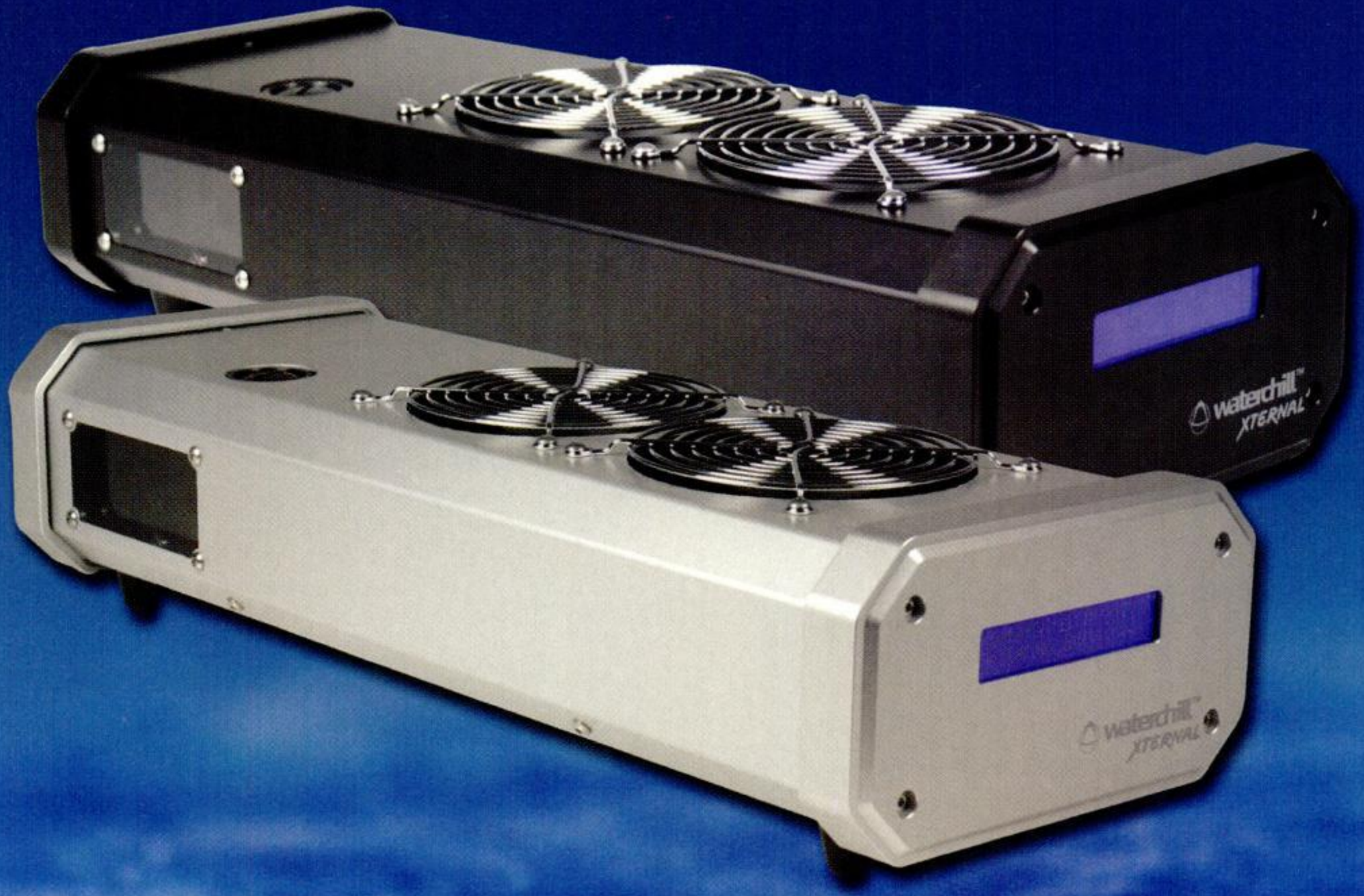

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used one screw on the bottom and another on the side (image a). Then lower the entire caddy into the drive bay and slide it forward using the black tab on the caddy until you make a connection (image b). Replace the hard-drive bay cover.

Step 18: Prepare to Remove the Optical Drive

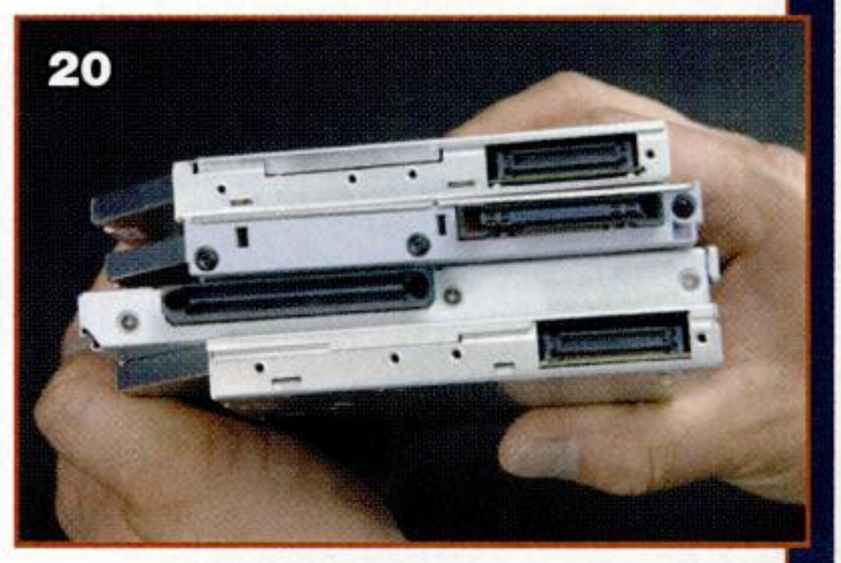
Now we need to replace the stock combo drive with a spiffy double-format, dual-layer burner. To begin, remove the screw next to the foot of the optical drive.

Step 19: Use Your Fingernails

Slide the drive out of its housing. Your fingernails should do the trick, but you might need to use a flat screwdriver to pull the old optical drive out of the bay.

Step 20: Underneath, They're All the Same Connector

On the top we have the original Philips combo drive that came with the AOpen kit. Under that is a Fujitsu drive, then an older Compaq Armada drive, and finally our new 8x NEC ND-6750A burner that we picked up from Newegg.com for $80. Although the Fujitsu and Compaq look like they have different connectors, they're really the same—you just have to remove the proprietary attachments. Why the different connectors? Compaq, Fujitsu, and the rest use modular bays for floppy drives, batteries, and other accessories, which require different pins and power than a standard slim optical drive. Luckily, our AOpen chassis uses a standard slim optical interface, so there's no need to tinker with the connectors.



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MXM Module Could Make Graphics Upgrades Easy

We chose the AOpen 1559 because it comes with the moderately powerful GeForce Go 6600 graphics, but it also has the potential to upgrade to a faster GPU down the road, thanks to its MXM I module. AOpen ships the notebook with the module, which is a good thing because stand-alone modules are nearly impossible to obtain. We're going to show you how to remove and upgrade the card on the off chance there will be an upgrade path one day.

Step 1: Remove Heatsink/Fan

The GPU is near the memory modules, so you'll need to open that compartment on the bottom of the laptop. The GPU is also cooled by a heat pipe, which you'll need to remove before you continue. Unscrew the single screw holding down the heatsink.

Step 2: Slide Out the Fan

With the screw removed, slide out the fan in the direction of the GPU until the tab holding it down is clear. You can now move the fan out of the way.

Step 3: Unscrew the Heat Pipe

Remove the heat pipe by removing the four screws clamping the pipe to the MXM module.

Step 4: Behold the MXM!

You can now remove the MXM Type I module by releasing the clasps, tilting it up, and pulling it out. The mounting is very similar to the SO-DIMM and Mini PCI card—insert the card edge into the slot at an angle and push it in until it stops and then tilt the card down. Will we one day get a GeForce Go 7800 card in this size that runs cool enough for our heat pipe to manage? No one knows, but we sure hope so.

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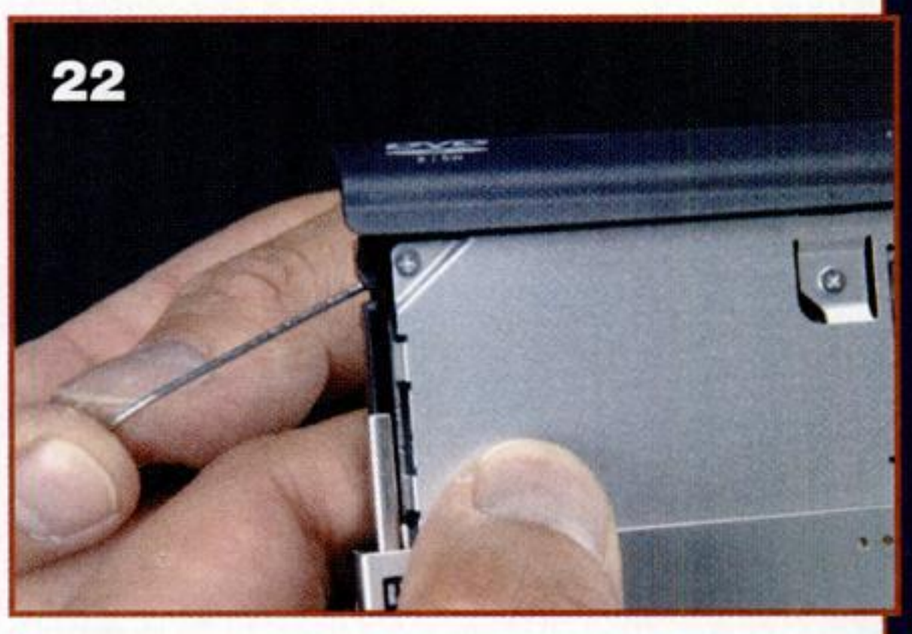
Continued from page 77

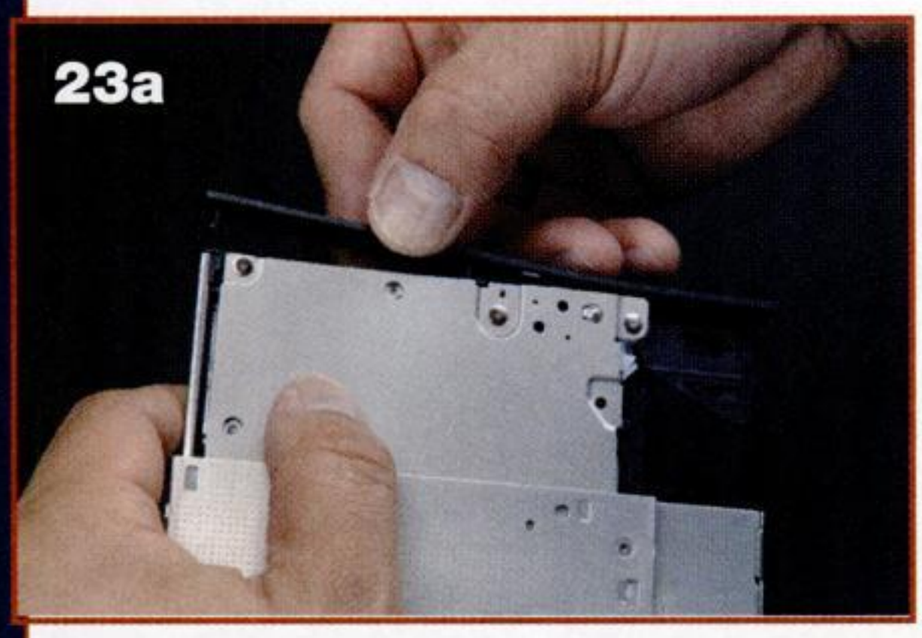
Step 21: Convert the Bezel

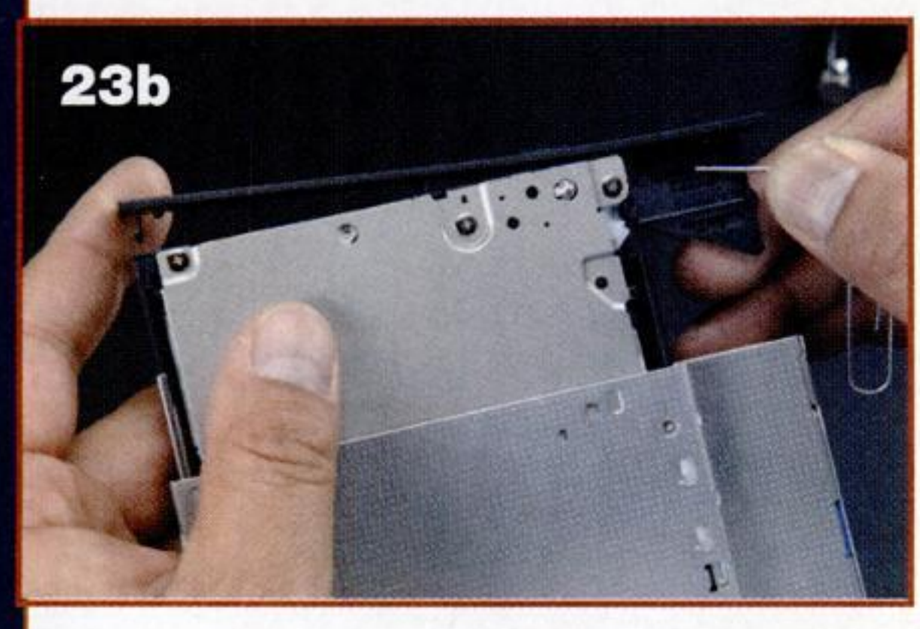
The bezel, however, is unique for each notebook, so you'll need to switch the stock unit on the NEC drive with the one that came with the laptop. Otherwise, the bezel won't be flush with rest of the laptop. Not all slim drives use the same bezel type, but fortunately for us, ours did. To remove the bezel from the stock Philips drive, first open the drive door using a bent paper clip.



Step 22: Unlock and Remove the Bezel

Remove the bezel by pushing in on the locking tabs with a paper clip. You'll need to push fairly hard to get the bezel to release. Once the tabs are loosened, you should be able to pop the bezel right off.





Step 23: Replace the Bezel on the NEC Drive

Now you'll need to remove the bezel from the NEC drive and pop the new one into place. You'll need to follow the exact same procedure to get that bezel off (image a), then pop the one that matches the notebook chassis onto the NEC drive (image b).

Continued on page 80

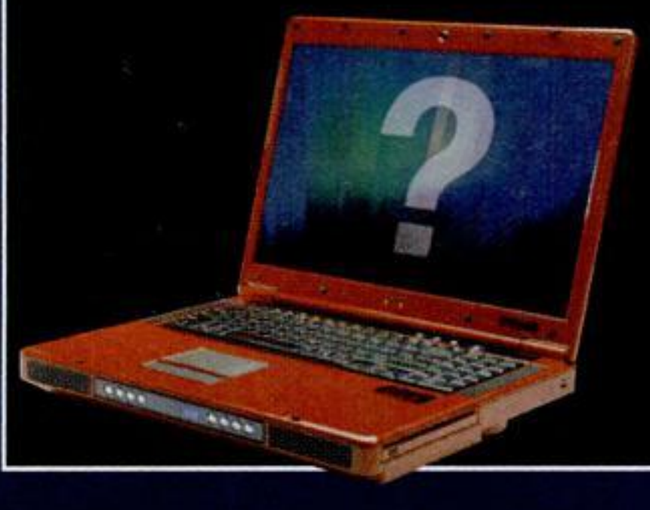
DIY vs. Prebuilt

Is there really anything our DIY rig offers over the OEMs? The answer is a definite yes!

We'll admit that the idea of building our own notebook seemed pretty impractical at first, but our DIY rig sports two features we've never seen from a prebuilt notebook, one of which we've wanted for years. The first is a six-pin FireWire port. The overwhelming majority of notebooks sport the nonpowered four-port variety. While the heyday of FireWire is long past, a powered-port lets you run more bus-powered devices, and if you ever need to flash the firmware on you iPod, you can do it from your six-pin port. Our notebook also includes support for both the new ExpressCard interface and the older PC Card standard. Most ExpressCard notebooks (even the Dell reviewed this month) simply jettison the PC Card from the chassis. That's just a little too legacy-free a little too soon for us.

We're also quite satisfied with our configuration. For $1,500, we get a notebook that performs at the top of its class in single-core processor speed (for benchmarks see In The Lab on page 82) and we get a Shader Model 3.0-capable GeForce graphics part, too. That's pretty hard to do in a $1,500 retail notebook. More importantly, when Microsoft Windows Vista ships later this year, we'll have full accelerated support for the Aero interface that most integrated graphics can't support.

Combine the configuration, features, and price with the fact that we built it ourselves, and we're just tickled pink over our DIY notebook.



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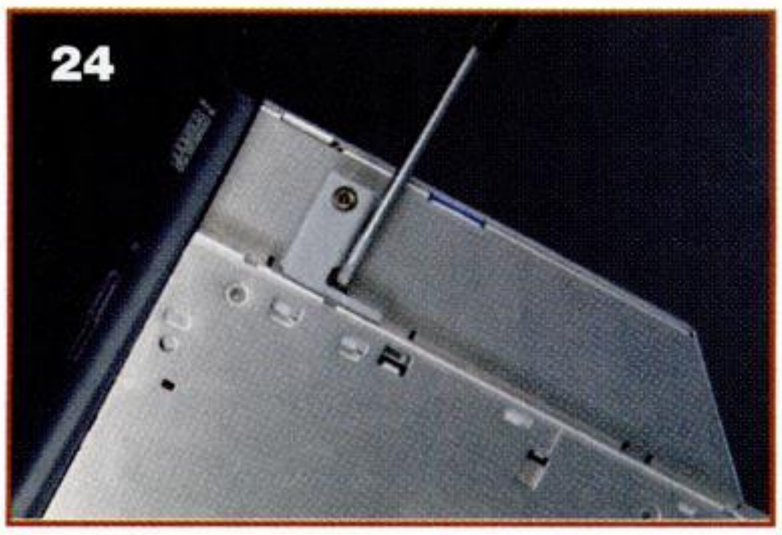

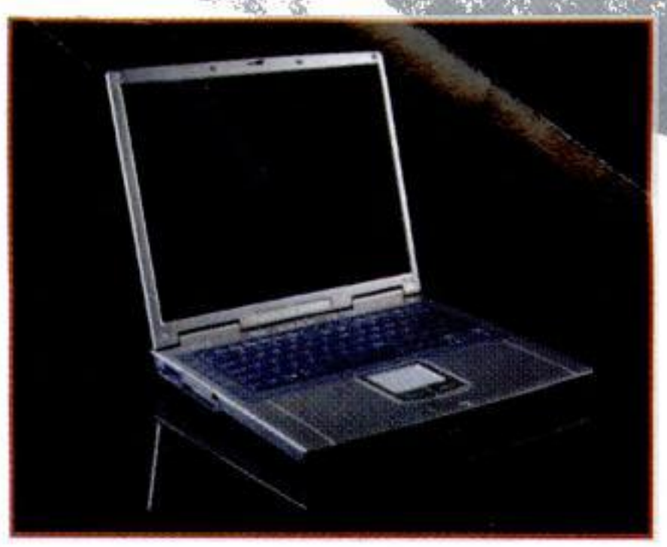

Step 24: Insert the Optical Drive

The last step in our drive transplant operation is to remove the metal arm that locks the drive into the notebook. Simply unscrew the single screw holding it in and move it to the NEC drive. You're ready to slide the drive back into the machine. Remember to reinstall the screw you removed in Step 18.

Step 25. Voila!

Our old combo drive is now replaced with an 8x NEC DVD burner that will also support dual-layer dics.

You're Done!

Install the battery, plug in the machine, and fire that baby up! Once you've ensured that your machine is booting properly, and that all the hardware seems to be working, you can pop your Windows CD into the drive and install Windows XP!

Continued on page 82 →

Don't Panic!

Rarely does a machine work on the first try, even for *Maximum PC* editors. Don't freak out, and don't call tech support yet. Here are a few common problems, and easy solutions if your machine won't boot.

Problem: My new notebook won't boot.

Solution: Assuming you didn't bend or break anything while you were building your notebook, the first thing you need to do is check the power switch. You should pop the middle panel loose and check to make sure you reattached the power leads or didn't accidentally disconnect the power lead from the motherboard during the build. If those are intact, you might have to reseat the processor or GPU (if you removed it).

Problem: My notebook will start to beep but immediately shuts down a few seconds after boot.

Solution: It's likely the processor is overheating as the result of an incorrectly installed heat pipe. You'll need to break the machine down and reseat the CPU and cooler. First, remove the middle panel and keyboard to access the processor and heat pipe. Make sure you tightened down the heat pipe properly, but don't overdo it. Remember, the Pentium M doesn't have a heat spreader to protect its delicate little core. Get too physical with it and you could crack the core. Also make sure the thermal pad—the little tab that looks like gum—is in place.

Problem: My wireless is not working or has poor reception when I'm standing next to my access point.

Solution: First, make sure the wireless is turned on: Press the first button to the left of the keyboard to turn on the wireless. (You can also set the machine to boot with the wireless enabled from within the BIOS.) If wireless is enabled, the antenna lead or leads might have popped off during assembly, or might not have been securely fastened during the build. Follow the steps to remove the middle panel and keyboard to access the Mini PCI slot and antenna leads, and check the leads. If Windows isn't even detecting the Wi-Fi (and you loaded the drivers from the CD), you should reseat the Mini PCI card.

Problem: My notebook will not go into an S3 sleep mode.

Solution: First, make sure you're using an OS that fully supports ACPI modes. Windows 98, Millennium, and 95 have problems with S3, or "suspend to RAM" sleep modes, while Windows XP and Windows 2000 offer full support. If you're running a 9x-based OS, it's time to upgrade, baby. If you're running XP or 2000, your problem may lie with drivers, or with something as odd as a Direct3D screen saver, such as the 3D Text that's included with XP. Microsoft has a hotfix for this problem, under Knowledge Base item Q306676. Or you can just switch screen savers. Otherwise, most sleep problems are directly related to bad device drivers. The drivers AOpen includes fully support standby and hibernate modes under XP, so if you're running a USB, PC Card, or ExpressCard device, you may want to remove it and its drivers to see if the issue corrects itself.

Problem: Even though the BIOS sees the SATA drive, Windows XP can't install to it during installation.

Solution: If you have the BIOS set to configure the SATA and PATA ports as "enhanced" you can get around the problem by setting the BIOS to "compatible." Alternately, you can dredge up a USB floppy drive to install the F6 drivers for the onboard SATA controller.

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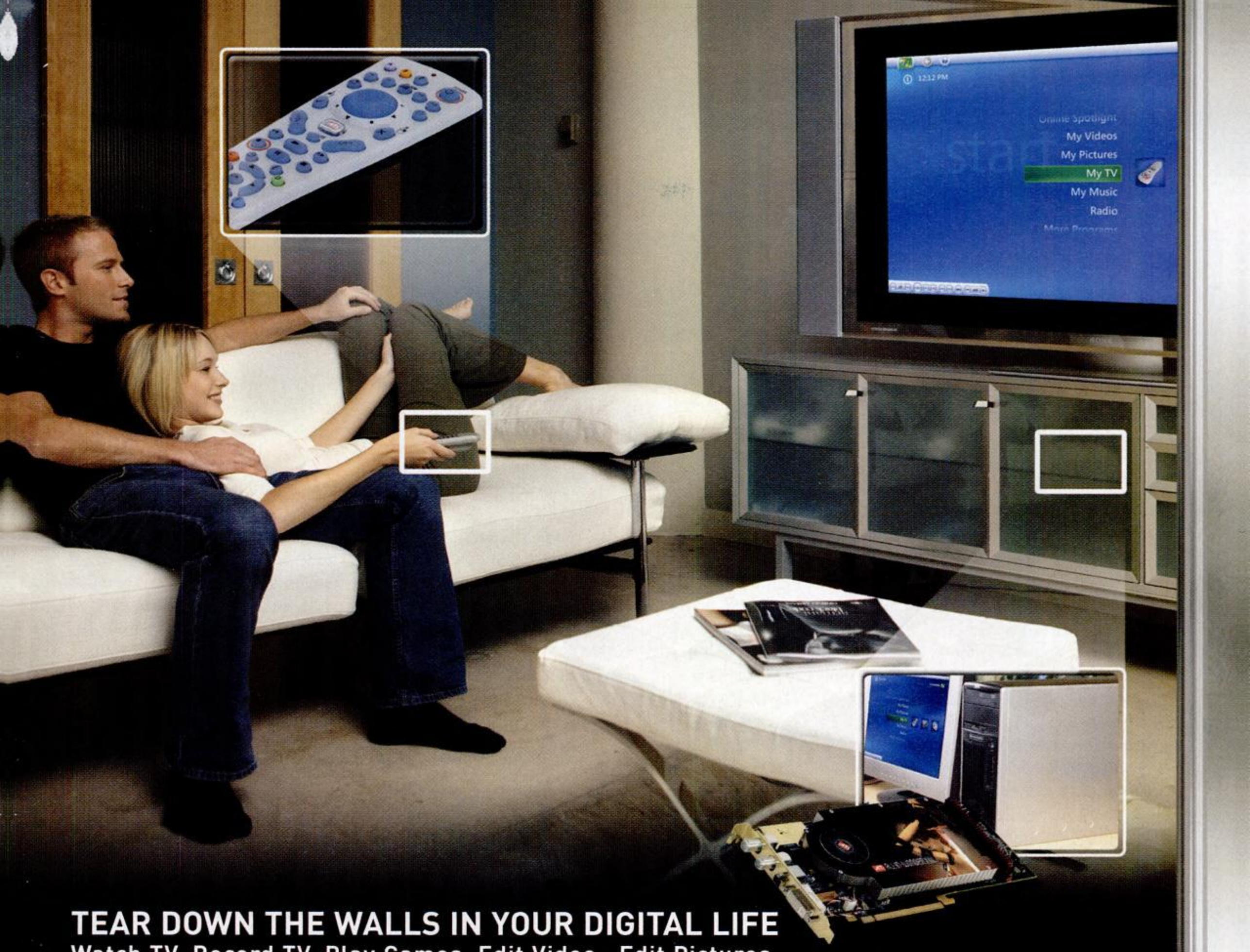

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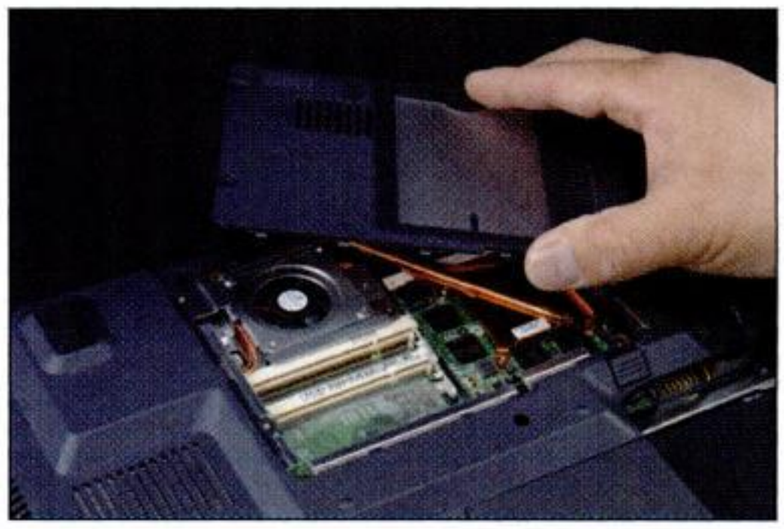
GORDON **MAH UNG**

Puts the DIY Laptop Through Its Paces

Can our home-built notebook take out Dell's new Core Duo Inspiron?



What do you do with a notebook after you've built it? Benchmark it!

I was tickled pink to have built a feature-rich notebook for a mere $1,500. But how does this baby perform? To find out, I put our new wunderkind through our set of standard notebook benchmarks and compared the results to the Dell E1705 with a 2GHz dual-core Core Duo proc, as well as to a second-gen XPS notebook that has the same 2.13GHz Pentium M CPU as the DIY.

While the DIY didn't do poorly in *SYSmark2004*, the Dell E1705 simply screams (for a notebook, that is). Between its dual-core design and its large 4MB cache, the E1705 holds its own in most benchmarks. But the dual-core pays huge dividends in the multithreaded *Recode* and *DVD Shrink*. The Core Duo was almost 50 percent faster than the Pentium M, and in *DVD Shrink* we saw nearly a 100-percent performance increase!

OK, our rig got its ass handed to it by Dell's dual-core, but it didn't do so badly against the second-gen XPS. Our $1,500 DIY was actually slightly faster than the $3,400 XPS in *Premiere Pro* and *Photoshop CS*. Why? The hard drive, bubba. Our 7,200rpm Seagate stomped all over the 5,400rpm drive in the XPS, with read speeds of 42MB/s versus 27.6MB/s. That's just enough to matter. However, the XPS and its GeForce Go 6800 Ultra demolished both the DIY and E1705 in all of the gaming benchmarks. There's no point in even running the numbers—putting a GeForce Go 6600 against a GeForce Go 6800 Ultra is like bringing a knife to a gunfight. Drat.

BENCHMARKS

	DELL E1705	DIY
SYSMARK2004 OVERALL	**209**	155
SYSMARK2004 INTERNET CONTENT CREATION	**282**	193
SYSMARK2004 OFFICE PRODUCTIVITY	**155**	125
NERO RECODE 7 (MIN:SEC)	**38:25**	56:24
DVD SHRINK (MIN:SEC)	**29:39**	57:3
Best scores are bolded.		

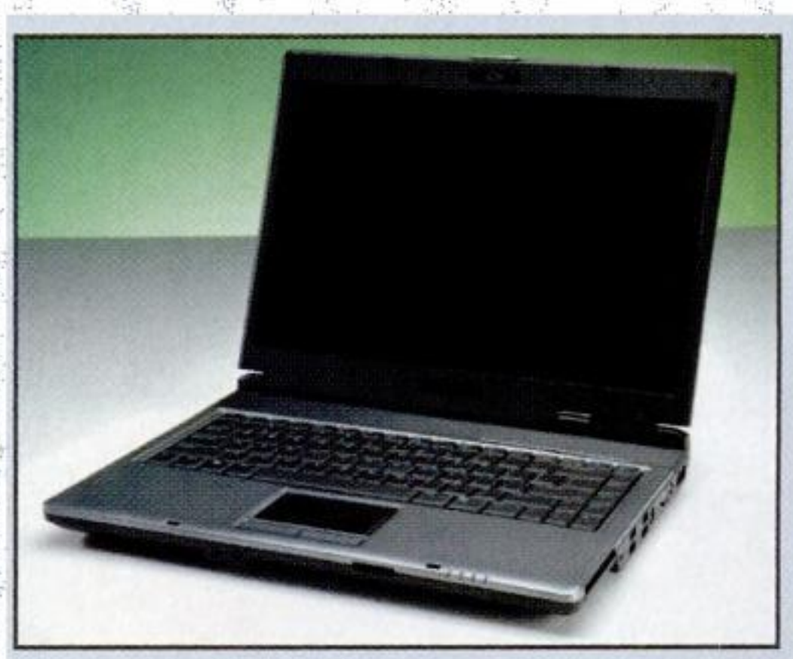
Dual-core Alternatives

Asus' new laptop chassis offer more flexibility

The Pentium M processor we used in our build is a fine chip, but there's a better choice today: Intel's Core Duo processor. This dual-core mobile CPU is essentially two Pentium M cores jammed onto the same CPU, and it shares 2MB of L2 cache. The Core Duo won't work in our Aopen notebook due to chipset constraints. However there are other options, such as Asus' new Z62J and Z62F notebooks. The Z62's both use the new Intel 945 notebook chipset, which supports Pentium M, and Core Duo. The Z62F uses integrated graphics while the Z62J uses nVidia's GeForce 7300 series videocards.

The Z62s also conform to Intel's new "Common Building Block" (CBB) initiative, which supposedly increases the interchangeability of parts between certain classes of notebooks. Right now, it covers hard drives and optical drives; 14-inch, 15-inch and 15.4-inch displays; battery packs and chargers; and keyboards. CBB doesn't translate into you immediately being able to swap that broken LCD panel from your Asus notebook with one from MSI or change the keyboard from US English to Russian. However, it gets us one step closer to this possibility.

What the CBB-complaint Z62F and Z62J do bring is really easy builds: both allow you install all of the major components using access ports on the bottom of the notebook. In fact, using the build-it instructions from our Aopen notebook, you can easily figure out how to build the Z62 except for two things: the Z62s use Mini PCI Express cards instead of the larger Mini PCI card in the Aopen (Mini PCI Express WiFi cards are a little tougher to find but surprisingly, we found a Lenovo card on Amazon for $69). The installation procedure is similar though. Removing the heat-pipe is also slightly different but the concept is the same. Hardware hackers used to poking around inside notebooks will have no problems getting the Z62's up and running. "Barebook" notebooks are still hard to find sometimes, but we located the "F" version with integrated graphics at Directron.com for $559. MPC



Want to build a dual-core laptop, then take a look at Asus' new barebooks.

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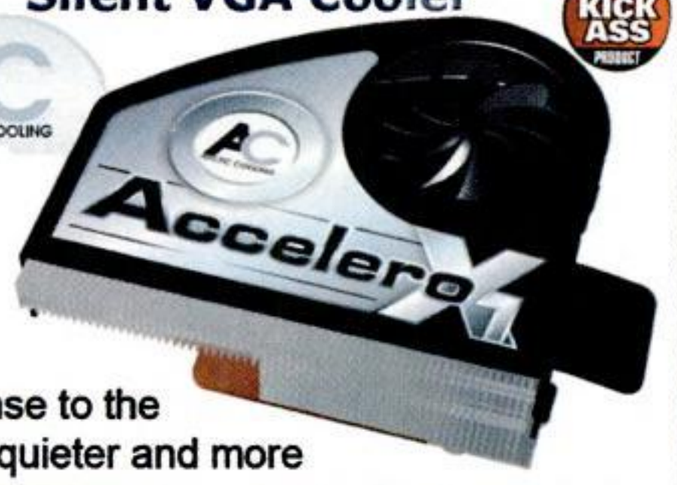

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Continued from page 86

Putting the Pieces Together

At this point, you need to assemble your rig, just like any other system. Build your rig, and then install Windows and all the necessary drivers, security patches, and updates, and your machine should be ready to go. Before you partition your hard drive during the Windows install process, consider creating separate partitions for your applications and data. Doing this makes backing up your data much faster, and prevents you from backing up data that doesn't change every week—like the contents of your C:\Windows folder. You shouldn't need more than 40GB for your Windows drive, so you'll still have tons of space for your media files. You should also give your machine a descriptive name (one that's easy to type) when the Windows installer prompts you.

Copying Your Media

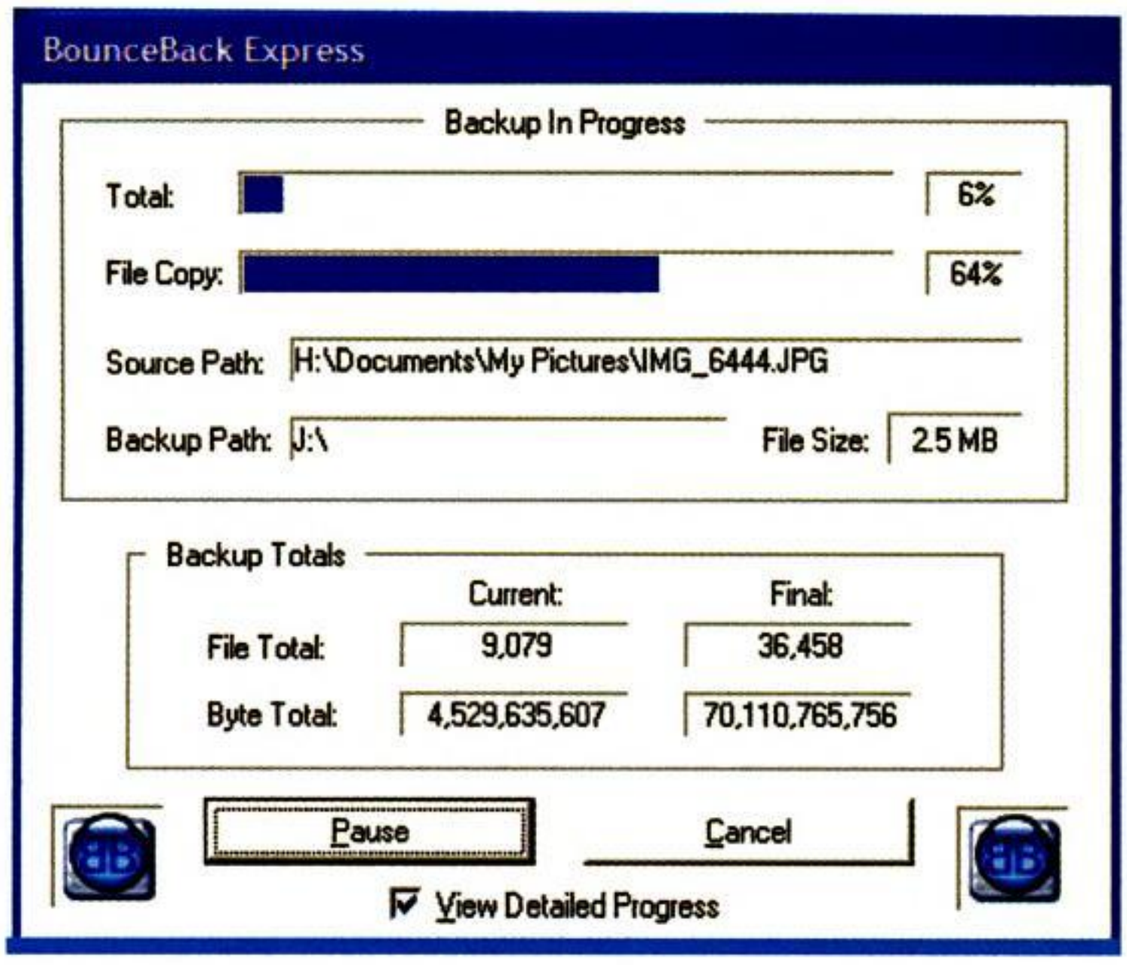
Now that your box is set up, you'll want to create folders for your separate media types off the root of your media partition. We recommend creating a Media folder on that partition, then creating subfolders for videos, music, and photos. You might even want to set up folders dedicated to downloaded files, ISO backups of your application CDs, or anything else. Now, start collating all those loose media files from your various PCs. You can copy them through the network, but if you're dealing with a few hundred gigs of data, it's much faster to use that external drive and run around your house, collecting all the media on it and then transferring it to its new home on your server.

Sharing with Others

Now that all your media is on your server, you'll want to make sure that other machines on your network can access it. Right-click each of the folders you want to access on the network, and select Sharing and Security. Check the box that says "Share this folder on the network" and give your share a descriptive name. If you want to be able to make changes to your files remotely, or add new ones, you'll need to check the box labeled "Allow network users to change my files." That will allow anyone with an account on the machine to add, delete, or change files on the server. You can manage accounts in the User Accounts Control Panel. You should be able to access any of the shared directories by typing **//name of server//name** of share in Windows Explorer.

Next, install software for any streaming devices you have, like a Squeezebox or a video streaming box. Once that's done, your server is up and running!

Maintaining Your Server



Luckily, most backup drives come with software such as *BounceBack Express* that makes it easy to schedule a weekly or monthly backup.

A good backup drive is essential for reliable operation of your server, but only if you run regular backups.

Because of its uptime, your media server needs even more protection from malware than your regular machine. Make sure you install antivirus software, and schedule automatic definition updates, as well as daily or weekly scans of all your drives during nighttime. Set up firewall software, making sure to open the ports that your streaming software and generic Windows networking use. The procedure for this varies based on the streaming software you use and the firewall, so you'll have to consult your documentation.

This is also the time to schedule a weekly backup to your external drive. Your backup drive should have come with software that will allow you to duplicate the filesystem of your drive. Don't fool with incremental backups or proprietary compressed archives, if your software supports them: They're not worth the hassle, and because you're backing up heavily compressed media, there won't be any space savings. MPC

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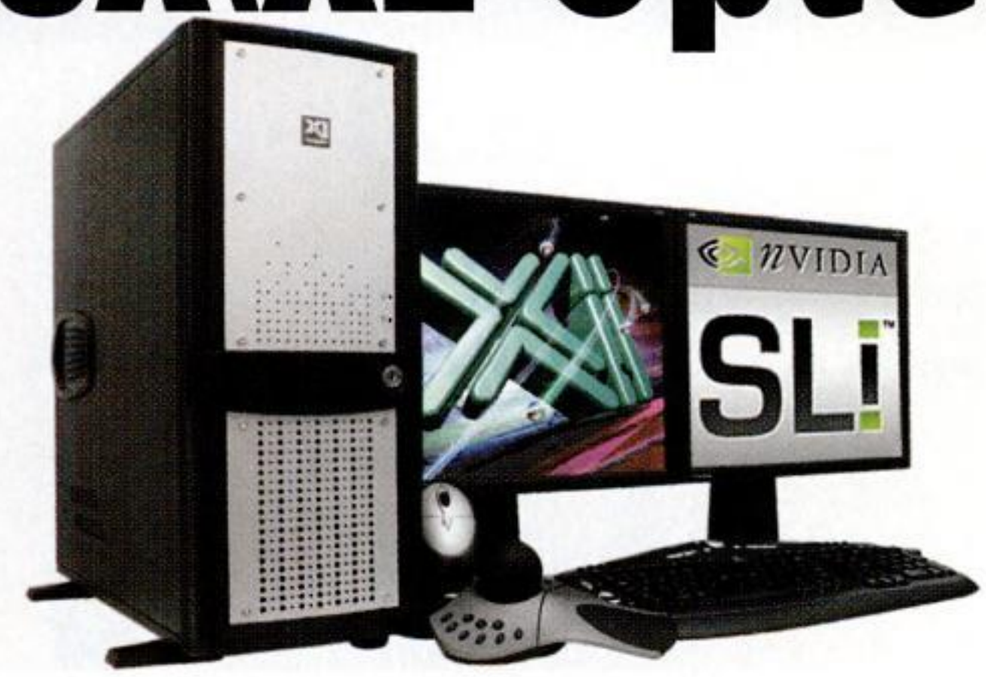

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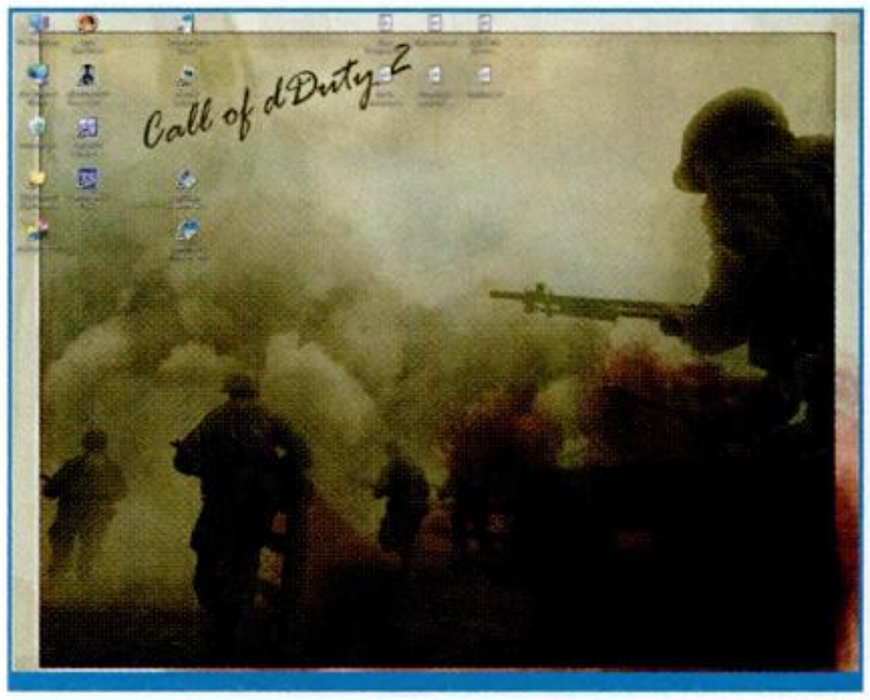
Migrate to a New PC

You've built an amazing new PC and you're ready to kick your dusty old computer to the curb, but you can't part with your email, your MP3s, your wallpaper, or your myriad desktop customizations. The answer: Migrate the old to the new with the Files and Settings Transfer Wizard

TIME 1–3 HOURS

It's been far too long since you've enjoyed computing power beyond your wildest dreams. Back when you got your old PIII 800MHz computer with its 512MB of RAM, you thought you could rule the world, but now you can barely run a screensaver with that old mummy. Naturally, you built a new computer from scratch rather than buy one (or you're in the process of doing so, with the help of this magazine), and the new horsepower is great. But you don't want to lose any of the little things you've done over the years to make your old PC *yours*.



You've accrued gigabytes of data: documents you created, CDs and movies you ripped, photos you downloaded from your digital camera, apps and demos you grabbed from the web, and miscellaneous files galore. Not only that, but you've also tailored Windows to your whims, tweaking everything from the desktop (you really don't remember where you got the groovy *Call of Duty 2* wallpaper) to the folder settings, and everything in-between.

Your desire is clear: You want to completely replace your old PC with the new, and you don't want to spend days getting moved in. What you need to decide, and quickly, is how to transfer all that stuff from the fossil to the powerhouse, and fast.

Good news: Microsoft built the Files and Settings Transfer Wizard (FSTW) into Windows XP to make life easier for people in just your situation. The FSTW is part of the operating system, so it's built for Windows and it won't cost you extra like a great many third-party solutions would. It's also versatile, allowing you to transfer folders, files, and settings of your choosing in many different ways.

BY JOEL **DURHAM JR.**

Continued on next page→

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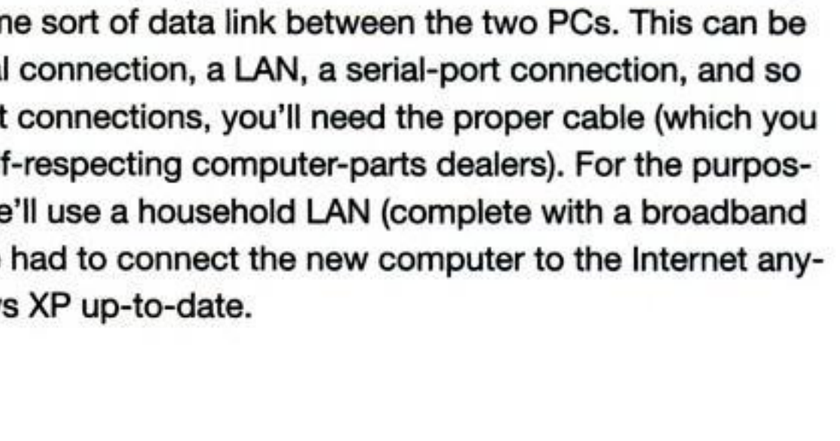
Continued from previous page

Prepare to Transfer

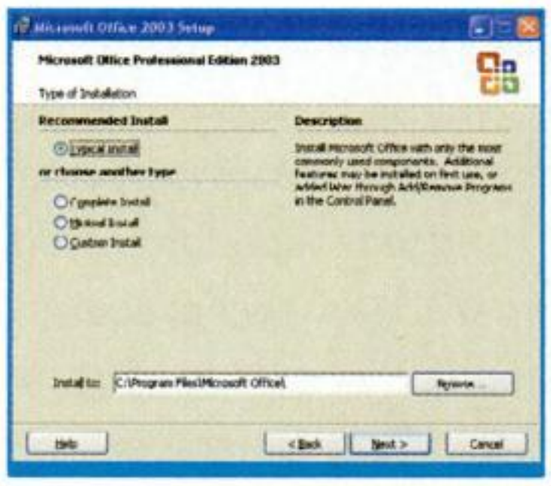
Here's your new desktop — looking generic and Windows-y, which is just plain embarrassing to a power user. However, before you get started with the actual migration of your data and settings, you have to take a few measures to prepare both PCs for the big move. Of course, you should install Windows XP on the new PC, update it, and install all of the necessary drivers for the motherboard, the graphics card, the sound card, the LAN hardware, and anything else you might have packed into the case. You should also update Windows with all of the latest hotfixes and security patches. When Windows XP is raring to go, you're ready to start your migration preparation.



1 Back Up Your Files!

Before you do anything to the important data on your old PC, back it up. Use a backup program such as StompSoft's *BackUp MyPC* (shown here), or simply drag all of your critical files to a DVD+R or other removable media. Of course, you don't need to know this because you perform regular backups every day, right? *Right?*

2 Install Applications on Your New PC



The FSTW supports lots of applications, especially Microsoft applications (naturally). It will not, however, transfer entire apps to the new computer — only their settings. Before you migrate, you should dig out the installation media and install all of the apps whose settings you want to retain on the new PC. Install everything you use, including utilities, games, and other applets. If you install your applications in the same folders on the new drive as they were on the old, you can automatically transfer items that the wizard doesn't directly support, like game-saves and other such data.

3 Get Connected

Though you can use the FSTW with removable media, such as writable optical media or, god forbid, floppies, the easiest and most efficient way to use it is with some sort of data link between the two PCs. This can be a null-modem serial connection, a LAN, a serial-port connection, and so on. For port-to-port connections, you'll need the proper cable (which you can get at most self-respecting computer-parts dealers). For the purposes of this article, we'll use a household LAN (complete with a broadband router) because we had to connect the new computer to the Internet anyway to get Windows XP up-to-date.

4 64-Bit Update

If you're using the 64-bit version of Win XP or you're moving to the OS with your new rig, fire up Windows Update (click Start, navigate to All Programs, and click Windows Update), and when the option comes up, select Custom. Navigate to the non-critical (optional) Windows updates and start expanding those labeled "Update for Windows XP" until you find one that discusses the Files and Settings Transfer Wizard. If you don't see this option, then good — you're all set. If it's there, select it, install the selected updates, and reboot if you're prompted to.

Continued on page 95

What Gets Transferred?

The Files and Settings Transfer Wizard does its best to make your transition from your old computer to your new one as effortless as possible. This process entails moving as many settings as possible, and virtually any files you deem fit for transfer.

As far as files go, the wizard transfers anything you wish by file type, by location, and through a dialog box that lets you browse the hard drive of the old computer and select files and folders for transfer. It automatically allows you to move many of the common files and folders found in a typical XP setup (for instance, the various My... folders).

The Wizard also transfers numerous settings, including those for:

- Accessibility
- Internet Explorer (including Favorites and cookies)
- The desktop
- Microsoft Office
- Outlook and Outlook Express settings and data
- Dial-up connections (including phone and modem settings)
- Screensavers
- Fonts
- The taskbar
- The mouse and keyboard
- Sound
- Network shares (including drives and printers)

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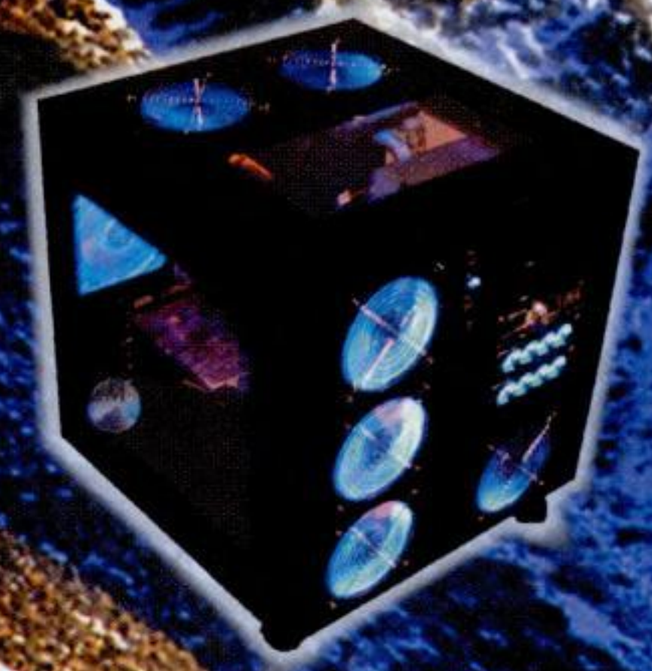

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Continued from page 92

Time to Migrate!

Files and Settings Transfer Wizard
Do you have a Windows XP CD?
You will also need to run this wizard on your old computer. You can either create a wizard disk to use on your old computer, or use the wizard from the Windows XP CD.
To create a Wizard Disk, insert a blank, formatted disk into this computer's disk drive. Make sure the old computer has the same type of drive.
I want to create a Wizard Disk in the following drive:
I already have a Wizard Disk
I will use the wizard from the Windows XP CD
I don't need the Wizard Disk. I have already collected my files and settings from my old computer.
< Back
Next >
Cancel

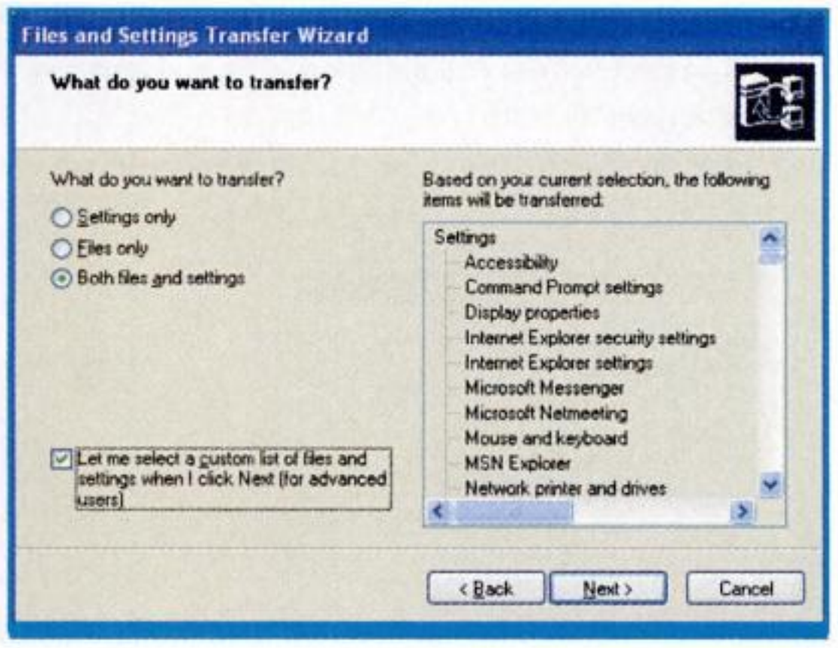
1 Start the Files and Settings Transfer Wizard on the New PC

Click Start and navigate to All Programs > Accessories > System Tools, and select Files and Settings Transfer Wizard. Select New Computer and click Next. If your old computer is running an operating system other than Windows XP, such as Windows 9x or Me, create a "Wizard Disk" by following the prompts. Otherwise, proceed to Step 2.

2 Start the Files and Settings Transfer Wizard on the Old PC

If the old computer is running Windows XP, start the wizard as described in Step 1. If not, insert the disk that you created in the step above and launch the wizard from it. Since we're using a home network, we'll select the option shown.

Files and Settings Transfer Wizard
Select a transfer method.
Direct cable (a cable that connects your computers' serial ports)
Home or small office network
A network is the best way to transfer large amounts of data.
Floppy drive or other removable media
Make sure both computers have the same type of drive.
Other (for example, a removable drive or network drive)
You can save files and settings to any disk drive or folder on your computer.
Folder or drive:
Browse...
< Back
Next >
Cancel


Files and Settings Transfer Wizard
What do you want to transfer?
What do you want to transfer?
Settings only
Files only
Both files and settings
Let me select a custom list of files and settings when I click Next (for advanced users)
Based on your current selection, the following items will be transferred:
Settings
Accessibility
Command Prompt settings
Display properties
Internet Explorer security settings
Internet Explorer settings
Microsoft Messenger
Microsoft Netmeeting
Mouse and keyboard
MSN Explorer
Network printer and drives
< Back
Next >
Cancel

3 Tell the Wizard What to Transfer

If you're using a data connection rather than removable media, the wizard gives you several choices and a checkbox to contend with. Decide what you want to transfer: files, settings, or both. If you wish to select a custom list of files, fill in the checkbox as shown.

4 Make a List and Check It Twice

The FSTW then presents a list of things it will automatically transfer. Check it out, and remove anything you're not interested in. Use the buttons on the right to add any other files and folders you desire through a simple browsing interface. Repeat as necessary until you've selected all of the files and folders you wish to transfer. Remember to include your documents, music, pictures, movies, downloads, and game-save folders.

Files and Settings Transfer Wizard
Select custom files and settings.
The following list displays the folders, file types, and files to be transferred to your new computer. To add additional items, click the appropriate Add button. To remove an item, select it, and then click Remove.
Settings
Accessibility
Command Prompt settings
Display properties
Internet Explorer security settings
Internet Explorer settings
Microsoft Messenger
Microsoft Netmeeting
Mouse and keyboard
MSN Explorer
Add Setting...
Add Folder...
Add File...
Add File Type...
Remove
< Back
Next >
Cancel

Files and Settings Transfer Wizard
Collection in progress...
Please wait while the wizard collects your files and settings...
Collecting your user settings...
< Back
Next >
Cancel

5 Hurry Up and Wait

The wizard will search your computer for files, folders, and settings according to the criteria you specified in Step 4. This process can take a while, so go grab a sandwich or something.

Continued on next page→

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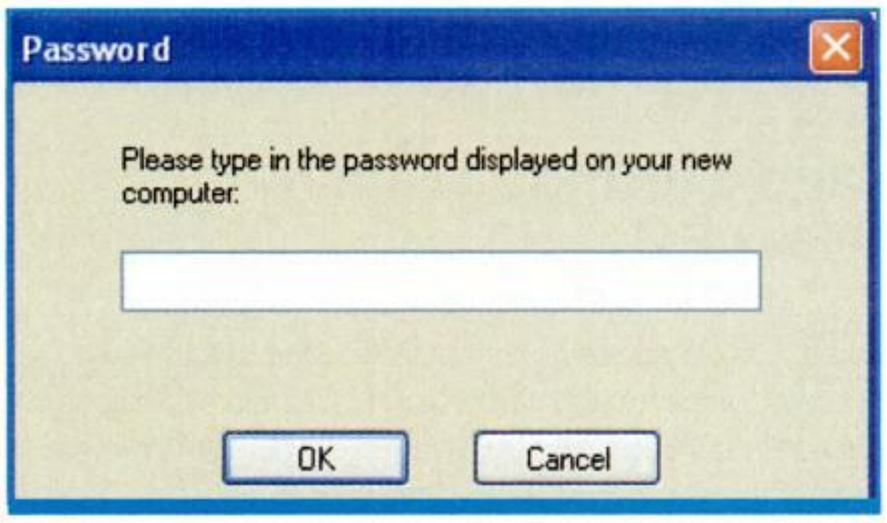
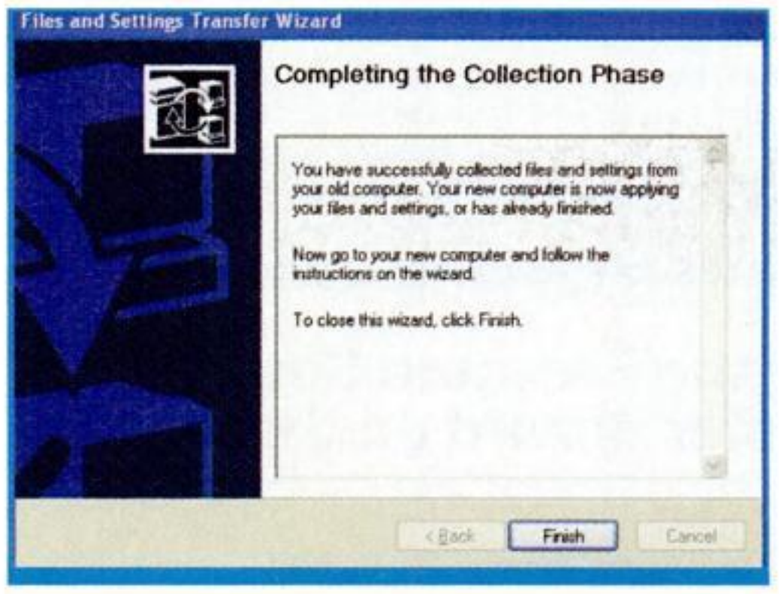
Time to Migrate!

Continued from previous page



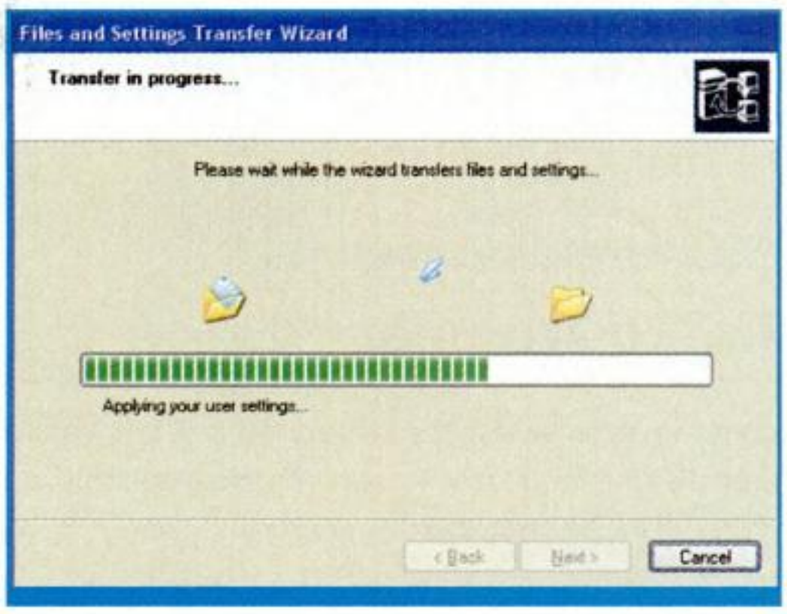
6 Enter the Password

During the search, the wizard may display a password on the *new* machine that you have to enter on the *old* one. This step is to prevent hackers, spies, and disgruntled employees from using the wizard to steal a whole bunch of stuff from your computer. Enter the password, which is a case-sensitive, randomly generated alphanumeric sequence. Then repeat Step 5.


Files and Settings Transfer Wizard
Completing the Collection Phase
You have successfully collected files and settings from your old computer. Your new computer is now applying your files and settings, or has already finished.
Now go to your new computer and follow the instructions on the wizard.
To close this wizard, click Finish.
< Back
Finish
Cancel

7 Complete the Collection Phase

When the computer is finished searching for transferable files and settings, you'll see this box. Select Finish and head over to the new computer. You're done working on the old one, but leave it on and connected to the new one.


Files and Settings Transfer Wizard
Transfer in progress...
Please wait while the wizard transfers files and settings...
Applying your user settings...
< Back
Next >
Cancel

8 Transfer in Progress

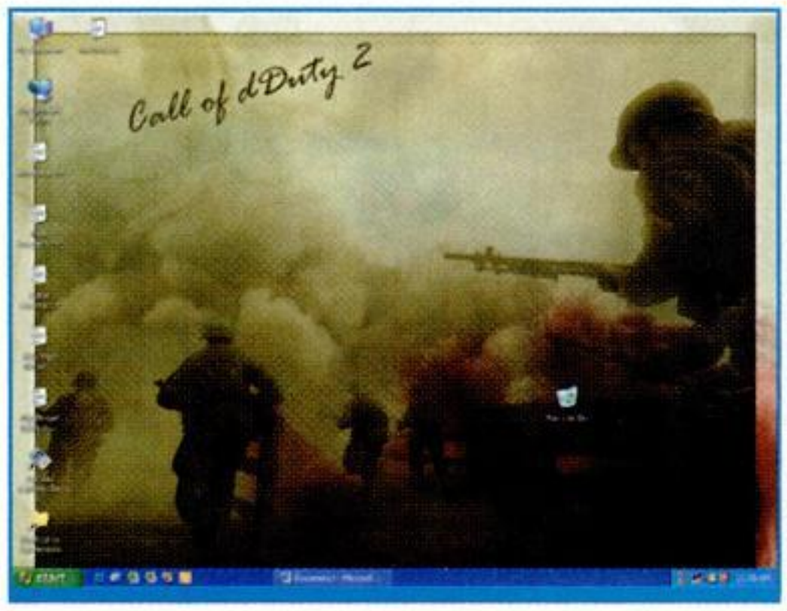
When you get there, the new computer will probably be busy transferring over all of the stuff from the old one. Depending on the number of files and folders you selected in Step 4 and the speed of the connection, this process could take anywhere from a few minutes to a few hours. For example, if you used a null-modem serial cable to transfer the data, you might as well go out for a few drinks. If you're using a gigabit network, the transfer will take much less time.

Files and Settings Transfer Wizard
Completing the Files and Settings Transfer Wizard
You have successfully transferred your files and settings from your old computer to your new computer.
To close this wizard, click Finish.
< Back
Finish
Cancel

9 Finish Up

The new computer will display this dialog box. Click Finish. Next, it'll probably prompt you to either log off or reboot your PC.

Now, it's time for the acid test: see if the transfer worked. The first sign that it worked is the new computer displaying your old computer's desktop — if you didn't remove the desktop settings from the list in Step 4, that is.



10 Check Everything!

Finally, you should double-check that everything you wanted to migrate was transferred successfully. Scour the hard drive and make sure all of the files and folders are where you expect them to be. Check application settings, folder options, email, and so on. The wizard should catch everything, but on the off-chance that it misses something and doesn't alert you, it's better to be safe than to lose important data. MPC

Post-Migration Cleanup

After the migration, you're ready to plop that new PC into your old computer's place. If any files turned up missing during Step 10, copy them over manually. We strongly suggest that you keep the old computer — or at least its hard drive — intact for a few weeks after the transfer, just in case you missed something critical.

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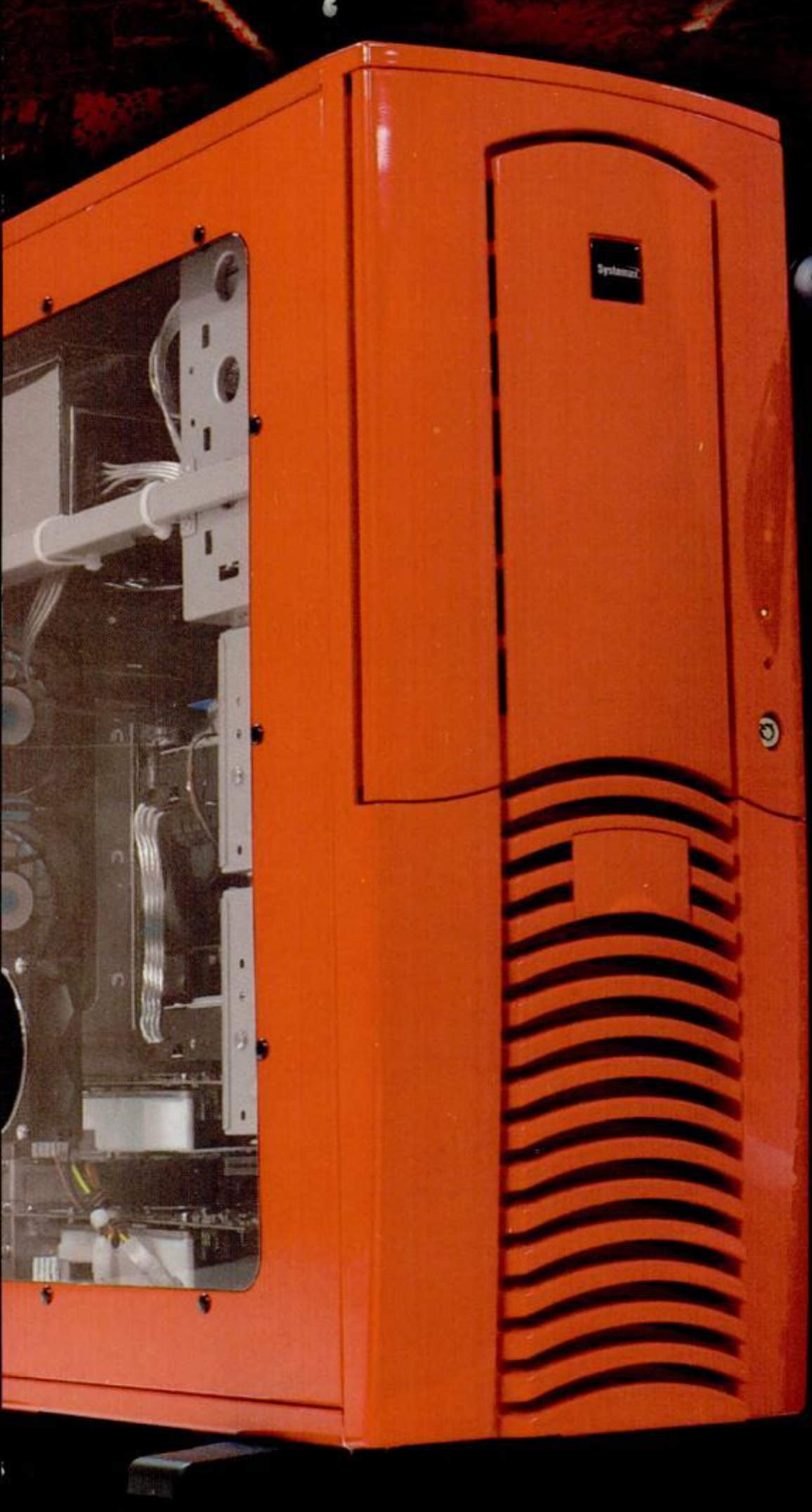

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